JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

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EDITORIAL NOTES—GAS, &c.

An Opportunity Missed.

THE New York State Commission on Gas and Electricity have missed a fine opportunity; and it has not been for the want of the best authoritative advice that could be proffered them. Early in the year, the Commission decided to fix the limits of illuminating power and purity of the gas supplied by the Companies coming under their jurisdiction; and this they have now done. Before doing so, however, they consented to receive a report on the subject from a Committee specially selected by the Companies concerned; and a stronger Committee of three, or a Committee in whose judgment and recommendations one could have greater confidence, could not have been chosen. Dr. Alexander C. Humphreys, Mr. Alfred E. Forstall, and Mr. R. M. Searle are gentlemen whose technical attainments and ability command profound respect not only in the States, but in this and other countries. While a minor point or two in the Committee's report might be open to a little controversy, the document taken generally will be read with a keen sense of gratification, and, in truth, it constitutes the greatest compliment it is possible to pay to the principles of gas testing embodied in modern British law and regulation. But that gratification is damped by the order of the State Commission. It was open to them, and the Companies' Committee pointed the way, to take a most important step towards universal gas testing. It would, indeed, have been a strong lever for use in the realization of that end to have been able to point to unity of practice between Great Britain and the State of New York. On the first blush universal practice looks a big thing to strive for; but nothing is impossible where scientific enthusiasm rises superior to the prejudices within national boundaries. In the gas industry of the world, inharmonious testing standards and systems are the obstacles to a ready and true appreciation of the progress made in efficiency in gas invention as between country and country; and we should on this ground alone have given cordial welcome to the conforming in the State of New York of the system of testing for illuminating power and of the conditions of gas supply with British practice as suggested by Dr. Humphreys and his colleagues.

It would have been instructive, but we suppose it is too much to hope for disclosure, to have learnt why the Commission have thought fit to prescribe illuminating powers higher than suggested by the Committee, and unnecessarily circumscribing conditions in regard to purity. The Commission have made a retrograde movement. They have gone back into the past, and have effected a start at a place that in this country has been left far behind; and we may venture to prognosticate that the time will come when the Commission will confess, by act, that in 1907 they were mistaken in not accepting, as they were urged to do by the Companies' Committee, the teachings of experience in a country where testing and coercive conditions in regard to gas supply have been more severe and exacting than in any other country—teachings which convince that too much rigour in gas supply is useless and injurious to consumers. If ever there was a time when gas required fettering, that time has gone. It could only have been when the bulk of gas was burned for its unaided luminosity, and not now when the bulk is used in atmospheric burners of various kinds, and per burner much less is required than formerly, and when, too, the competition of other illuminants is so keenly conducted that this competition alone has a controlling influence as between supplier and consumer. The stringent regulation that at one time obtained in many places in this country, was the issue of the mistaken notion that the Companies solely regarded their own narrow and selfish interests; and we can only fancy the New York State Commission have been led on by a similar chimera. The mistake of the past has been recognized here; and may we not hope that the Commission will speedily rectify it in New York State?

The standard illuminating powers prescribed by the Commission are 16 candles for coal gas, 18 candles for a mixed coal gas and carburetted water gas, and 20 candles for carburetted water gas alone. The Companies' Expert Committee recommended respectively 15, 17, and 19 candles. The first question that naturally arises in considering these figures is, Why these differences between the illuminating powers of the various compositions of gas? And the first question induces a second, Have the differences anything whatever to do with compensation for variations in calorific power? Even assuming an affirmative answer is correct for the second question, such high illuminating powers are absolutely wasteful and useless. The Companies' Committee themselves—though they recommended in their report 15 candles as the standard for coal gas—gave excellent reason why (though they did not advocate it), it should be lower still. They indicated very plainly the difficulty of constantly maintaining such an illuminating power from the coals economically available, and under the restricting manufacturing circumstances of those works not large enough to adopt carburetted water gas. The climatic conditions of New York State are also such as to make ordinary enrichment for a not inconsiderable part of the winter valueless to the consumer; and so the expense is a squandering of money that might with greater advantage remain in the hands of the consumers. By fixing 16 candles as the quality of coal gas, the Commission are compelling to this waste, which even the support of the disappearing luminous gas-flame cannot justify.

Again, in prescribing the burner to be used in testing, the Commission have done their best to introduce complication and further want of uniformity. They give the supply Companies the option (according to which may best be suited to testing their gas) of the "new style F" argand burner or "the old style D" argand burner, or a No. 7 slit-union Bray burner; and tests are to be made with the consumption of gas fixed at 5 cubic feet. If these argands are those that we know under the distinguishing letters "F" and "D" in this country, then, with different burners in use by different companies, with fixed gas consumptions and fixed air supplies, and with gas of various compositions such as are distributed in the States, we can see a grand confusion in testing for illuminating power and in the measures of justice awarded to the various supplying companies, and so a want of comparability and equality. The Companies' Committee recommended the Metropolitan (Carpenter) argand No. 2 burner; and it passes comprehension why the Commission did not adopt the burner most suitable for the three standards of illuminating values and at the same time for the wide range of gas compositions found in the States. The bar photometer is to be adopted; and apparently the Commission intend the sperm candle to remain the standard of light, although the Companies' Committee favoured the authorization of both the Hefner-Alteneck amyl-acetate and the Harcourt 10-candle pentane lamps.

With reference to purity, the Commission have determined that, in regard to sulphuretted hydrogen, the gas shall show no trace; while the Companies' Committee advised something that gave a little more liberty. The Commission have also imposed a limitation for sulphur compounds of 20 grains per 100 cubic feet, notwithstanding the absurdity of such restriction has been completely exposed in this country, and restriction has been abolished in all but a few cases where the Companies have not yet approached Parliament for the relief. If restriction was absurd in this country it is even more so in the State of New York, where the coals used for gas making are less sulphurous than those generally employed in this country, and where carburetted water gas is so extensively distributed. Further, the Metropolitan Gas Referees do not now make any prescription as to ammonia. The Companies' Committee of New York State

similarly recommended; but the Commission have ordained that the gas shall not contain more than 10 grains of ammonia per 100 cubic feet, which is a generous margin compared with what formerly obtained in London.

We cannot avoid the feeling that the order of the New York State Commission is not in the interests of the gas consumers; it is certainly one that rejects past experience and modern practice. That this should be so, is a great pity.

To Stimulate the Competition of Oil.

The problem of domestic lighting has been under discussion in the "Oil and Colour Trades Journal;" and the correspondence has been crowned for the time being by an editorial article the purport of which is that people want educating on the great lighting problem—the duty of undertaking this task being remitted to that incoherent part of the commercial community known by the generic term as the oil trade. We are assuming that the "oil trade" comprises all the retailers, large and small, who are doing their best to cut each other's throats by selling oil, under the stress of competition, at the finest possible prices. If we are correct in this assumption, then the suggested educative work is, it follows, to be confided to very unsafe and unwilling hands; or, at any rate, there will not be a consensus of willingness to expend money on a very doubtful issue, which, if it had any prosperity at all, would unequally distribute the favours by conferring the greatest benefit upon those whose position enabled them to make the best tender to the public. This want of unity cannot possibly vie with *quasi* monopolies like gas and electricity in educative effort. It can well be understood that the astonishing progress of the system of gas supply by the prepayment meter has cut deeply into the oil business; and we can also appreciate (being constantly engaged in looking after the interests of the gas industry) the well-meant desire of our oil contemporary to energize the oil trade into a more combative mood in the competition of the illuminants. Our contemporary will not for a moment entertain the idea that the incandescent gas mantle and the electric light have solved the domestic lighting problem; and we, on our part, are pretty well sure—if we could grant that our contemporary was right—that the solution will not be found in oil. However this may be, we would point out to our contemporary that there is something that must precede education; and that something is indicated by its editorial article. Beyond, there is an insuperable difficulty to placing oil supply on a competitive equality with gas particularly, and to that we will also refer after dealing with the first point.

It is impossible not to admire the candour of our contemporary. It reviles gas.

> **The crude glare of the gas mantle . . . *seems* to have the effect of bringing into prominence the ugly features and damaging all that is beautiful; and gas will never be a perfect illuminant for internal purposes until some device is discovered by which complete combustion can take place. The incomplete combustion of gas in living rooms is responsible for more ill-health than all the germs about which pathologists make so much fuss; and yet we go on burning it without thinking at all about its evil results.**

The educational effort should begin at home; for our contemporary's knowledge appears deficient as to what Science has done through the bunsen burner in producing, by simple regulation, complete combustion of gas for lighting purposes; and we should certainly like to know more about the ill-health for which gas is held responsible by platitudinarians but not, as has recently been shown in our columns, by authorities. But hearken to this:—

> **We have been contented for 47 years (the introduction of mineral burning oil dating from 1860) to take from oil producers a partially refined product, evil smelling, and dangerous to use; and there is really no effectual demand for anything better.**

There we have the character of the stuff the oil trade is supplying set forth with frankness and truth, but not with completeness. "Evil smelling and dangerous!" And the writer of a representative organ of the oil trade in saying this has not allowed the ink to dry with which he has been abusing gas! The evil-smelling and dangerous qualities of the present commodity retailed for oil-lighting purposes is known well enough; but the point upon which, in the view of our contemporary, the public requires enlightening is that given a demand, a superfine oil can be produced which will be free from the inherent weaknesses of the present class of oils offered for lighting purposes. Why do not the retailers obtain from the producers such an oil, and start educating the public by comparison—by demonstrating to the public that there is purchasable an oil that will leave behind it "no nauseous effluvium to choke the lungs, to spoil "the decorations, and to kill the plants." We are afraid the retailers know as well as we do that such an oil must command a higher price, and that the pressure of competition—not so much within the oil trade as from the more convenient forms of illuminants—would place oil completely out of the running.

The mention of the word "convenient" brings us to the second point regarding an insuperable difficulty to the placing of oil on a competitive level with gas supply. This is a labour-saving age; and gas is the greatest of all labour savers in the domestic equipment. Oil has to be bought and stored; lamps have to be trimmed; and there is the danger of running short. It involves labour all round; and the very portability of the oil and of the means by which it is used increases its danger. Gas is always on tap, and is an ever-ready servant for lighting, cooking, heating, and for industrial use. It involves not daily, but only very occasional labour, and that of a very light character. Even electricity cannot compete economically in the manifold uses of gas. People appreciate this, and the appreciation is growing daily. That is the rock on which the competition of oil with gas must split, even if, in economy, light for light, it could compete with the incandescent gas-burner.

Industry and the Eight-Hour Miners' Day.

The report of the Departmental Committee who have been engaged in considering the economic effects of curtailing the working day of coal miners has been issued; and, taken on the whole, it is inconclusive, and not very emphatic. The miners cannot extract any comfort from it; and the Government will not obtain much leading from it. But while there is no great comfort for the one, or real leading for the other, the report throws so much light upon the complex considerations attaching to the great problem entrusted for solution to the Committee, that it can be said without any hesitation that there is no valid reason for interference with the present condition of things as they affect labour in mines. Physically the miner compares well with workmen in other industries; and he is not now by any means an overworked or under-paid individual. He takes good care that he is not overworked without the farce of statutory declaration that he is not to be imposed upon beyond eight hours a day. The average time he spends underground now, without legal limitation, spread over a week of six days only averages seven-and-a-quarter hours per day, or three-quarters of an hour less than the eight hours for which agitation is being made. If a statutory eight-hour day is provided, it is not likely that it will wean the miner from his inveterate liking for idle days; and we cannot help thinking that the Committee are taking a too liberal view of the matter of the limitation of hours, in describing as only probably temporary the result which they foresee of contracted output and embarrassment and loss to the country at large. Why they think this result will be only temporary is because it is believed the restriction to an eight-hour day (which is shown to be unnecessary) will increase the efficiency of labour and hasten the adoption of such labour-saving machinery as coal-cutters and conveyors. This expression of opinion as to the possibility of economically and largely dispensing with the services of numbers of miners by mechanical means should not be lost sight of by those concerned, and should press into their open view the imprudence of assisting to strengthen the case for adoption. The reports of the mines inspectors for 1906 show that there has been an increasing application of such plant. Giving due weight to the expressions of opinion by the Committee, there is no doubt that they consider the statutory limitation of the miners' hours would adversely affect those industries whose basis is the coal industry, by the immediate advance in price and in wages that would follow the reduction of output. This was the drift of the evidence given by Sir George Livesey before the Committee on behalf of the gas industry. That the Committee are mindful of the, considered from the important economic standpoint, injurious effects upon industry of the suggested restriction, is also seen from their recommendation that, in the event of the eight-hour day being established, the Department of the Government controlling mines should retain certain powers of suspension and of exception in the public interest.

Leaflets for Distribution.

With the sixth article published to-day, we complete the present series of "Illuminating Truths for Householders and Others." The articles have all been reprinted in the form of leaflets for general distribution among householders, shopkeepers, shareholders, and others; and they are useful, too, for stocking in show-rooms. The demand for these leaflets has been very encouraging; and it may be suggested to gas undertakings requiring quantities for distribution with their June accounts, that it will be well to give their orders in good time so as to prevent disappointment in delivery, as it has been impossible to even approximately gauge the extent of the demand.

Advice on Operating Water-Gas Plant.

In anticipation of the annual meeting of the Illinois Gas Association, the Secretary invited Mr. William I. Battin, the Superintendent of one of the stations of the Peoples' Gas Company of Chicago, to write a paper on operating water-gas plant—not a highly technical production, but one in which the men who actually work the plant would be able to find directions as to how to do it in the best way. Mr. Battin accepted the invitation, and sent in a paper which bears striking evidence of thoroughness. He might have contented himself with simply giving a dozen rules, and offering a few remarks upon each; but instead of doing this, he produced a contribution which, if printed *in extenso*, would fill ten columns of the "JOURNAL," and, by way of appendix, tacked on a useful bibliography of the subject. It will be seen, from the extracts from the paper given elsewhere, that the author has avoided technical terms, for the reason, as he explained at the outset, that, "while burettes and calorimeters are very useful in determining the design of machines, it is not necessary to use them in order to operate a properly constructed gas-machine at the highest possible efficiency." As requested, Mr. Battin wrote strictly for the workman; and his very first piece of advice to him is, before firing-up the plant, to make himself familiar with every part of it—to go through all the operations of changing valves again and again till he is quite sure he knows how it is done and what will be the effect. He should know something about the design of the apparatus, if it is to be worked to the best advantage. Mr. Battin gives most minute directions in regard to heating-up the plant, making the gas, putting in the oil, and clinkering. He specially cautions the workman never to make a run without watching the colour of the gas. When the plant is in good condition, it will be a rich golden yellow. If it is whitish, it has not been properly fixed; if brown, the oil is being over-cracked; if dark brown, the plant will be making lampblack in excess. The paper gave rise to a discussion, in the course of which varied experiences were narrated. In his reply, Mr. Battin confessed that his colleagues in Chicago did not all agree with him. It is scarcely to be supposed that they would. At all events, making every allowance for differences of opinion, he has furnished in his exhaustive paper a mass of information which operators of gas plant will do well to assimilate.

The Gas Profits Question at Bolton.

Bolton has taken its place among the growing number of towns in which opinion is not altogether on the side of the prevalent practice of allocating very large sums out of gas-works profits to the relief of the rates. The past year has been a successful one for the undertaking; the balance carried to the profit and loss account being £62,201. From this have to be deducted annuity, interest, and sinking fund charges; and the balance the Gas and Lighting Committee recommended should be disposed of by handing over £20,000 in aid of the rates and placing £16,414 to the reserve fund account. When the matter came before the Council, there was a tough fight over the proposal to assist the rates to the extent named; but eventually it was agreed to. The debate was naturally to a large extent on the familiar, and quite fair, lines that it is a great hardship on people who use a lot of gas to be forced by this means to contribute substantially to the relief of those who employ electricity solely, or perhaps a very little gas. But a point of particular interest was the reference to a resolution passed by the Council some years ago. This 1902 resolution, which was read to the meeting by the Town Clerk, was to the effect that, in the opinion of the Council, the yearly contributions of the Gas, Electricity, and Tramways Departments in aid of the rates should be expected to yield 2½ per cent. on the loan capital. The mover of the amendment at the last meeting—that the Committee's proposal to allocate £20,000 to the rates should be referred back—claimed that the effect of the resolution of 1902 was to practically limit the amount to be paid by the trading departments for rate relief to the 2½ per cent. named—the remainder to go to reserve. On the other side, however, it was claimed that this figure was really intended to represent the minimum amount of profit the ratepayers should expect to receive from their municipal trading concerns. Exactly what was in the mind of the Council when the resolution was passed, it is therefore not possible to decide; but if the 2½ per cent. laid down were taken as both a maximum and a minimum, the gas and electricity consumers and tram-car users would at any rate know exactly how they were situated—which would be decidedly better than a fluctuating demand on their pockets for the relief of the burdens of their fellow townsmen. Perhaps at some time or another the Council will again pass a "2½ per cent." resolution—and on that occasion make it clear that it is to limit the amount allocated to the relief of the rates, instead of leaving the exact meaning open to some doubt, as was the case with the last one. Meanwhile, the gas consumers will continue no doubt to handsomely remunerate the general ratepayer for (as one speaker put it) his "responsibility of seeing that the works are properly carried on."

A Word of Warning.

Last week a correspondent called attention to a communication which he (as Secretary of a large Provincial Gas Company) had received, and which seems to indicate that similar tactics in the promotion of grossly over-capitalized Gas and Water Companies to those already adversely criticized in our columns, are soon to be revived. The communication (evidently inspired by some of the now notorious group, though written from a private address in a London suburb) is as follows:—

> I am anxious to realize some shares in a gas company, and should feel very much obliged if, to enable me to do so, you could supply me with a copy of your list of shareholders. I should be pleased to recompense you for your trouble by paying you your charges for preparing same if you will let me know how much it will come to for your list. I enclose a stamped addressed envelope, and will esteem it a great favour if you will let me know how soon you could supply me with such list, and the number of names approximately contained in it.

Our correspondent—suspecting the object in view—does not intend complying with the request, which he says is the third of a similar class he has lately had. A word of warning to other secretaries may prevent them complying with a request that is all too likely soon to trouble their proprietors with prospectuses only fit for the waste-paper basket.

The Prospect of Dearer Gas in London.

Mr. Charles Carpenter, the Chief Engineer of the South Metropolitan Gas Company, has been interviewed by a representative of the "Evening News" on the subject of the rise in the cost of coal, and its probable effect on the price of gas. In the course of the conversation, Mr. Carpenter, referring to his Company, is reported to have said: "We have just ordered 1,000,000 tons of coal at 12s. per ton free on board ship at Newcastle. That is an advance of 3s. 6d. per ton on our last contract; and perhaps the following shipments, which we shall require before long, may cost us even more. It means that our consumers of gas will have to find the extra £150,000; and, naturally, the price will have to be immediately raised. The Board have not decided yet to what extent they will put up the price; but it will be known very soon. In order to stave off the evil day, we have been ordering coal from Yorkshire, which is not quite so good as that from Durham; but the collieries in the former county have become so busy that their prices are now as high as the others. We always work very closely, and do not keep reserve stocks; so that the gas consumer gets the benefit when coal is cheap, but when it is dear he has to help pay the difference. The taking off of the coal tax has caused the trouble. English gas coal is eminently suitable to Germany, France, and Belgium; and now the tax is removed, they can have it sent over there nearly as cheaply as we can obtain it in London. Their demands have come in such volume that the collieries can hardly cope with them. How long the inflated prices will last I cannot say; but there seems to be an air of unrest throughout the coal industry. The legislation of the Government is causing uneasiness to the trade. The Compensation Acts have made coalowners anxious to keep prices up as high as possible; and with the prospect of an Eight-Hour Day Act being passed, which means a great reduction of output, they will not be able to lower prices hurriedly. House coal is almost bound to go up, in consequence of the present boom. Some of it makes good gas coal; and there is already a big demand for it. The hands of the coalowners in the Midlands and Lancashire will therefore be forced in the matter."

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 606.)

We were able to note last week that just before the Stock Exchange closed for the Whitsun holidays, things had taken a turn for the better, and members dispersed with the pleasing prospect of having a still better time upon the reopening. But when the markets did reopen on Tuesday, it was soon apparent that a rude disappointment was in store. There were still many absentees, and business was quite lethargic. Everything was dull and very heavy, mainly under American influence; but a small amount of buying propped the gilt-edged division up a bit. Business on Wednesday was very dull; and all descriptions went down, with Consols at the head of them. It is sometimes hard to understand what it is exactly that sets these movements in action, for markets now are so terribly sensitive that they are taken aback by the slightest puff. The state of things was almost disheartening on Thursday. Low prices were bringing out pawned stock for realization, with the inevitable result of making them lower still; and a handful of buyers are powerless to stay the rot. On Friday things were about at their worst, and Consols had touched 84⅛ more than once, when a turn for the better set in, and buyers plucked up a little courage. This was maintained on Saturday, and there was some recovery in prices in most lines. In the Money Market, there was a good demand; and rates obtainable for short loans and for discount slowly and steadily hardened. In the Gas Market, business reopened with some animation, and for the first day or two it seemed as if it was going to be an active week. The pace slackened after a bit, however, and the close was quiet. There were not many changes of quotations; but, as might be expected in such times, they were mostly downward. Some of these reductions are not easily explicable. In Gaslight and Coke issues, the ordinary started off very well, but quieted down later on. Prices were steady—ranging from 92¾ to 93⅛. Little was done in the secured issues; the maximum marking 88, the preference 103¼ and 102½, and the debenture 83⅛ and 84½ South Metropolitan was moderately dealt in at a rise of 1 in the quotation; stock changing hands at from 122 to 123½, and ditto debenture at 84. Nothing at all was marked in Commercials. There was rather more doing in the Suburban and Provincial group. Alliance new marked 14⅜, and then fell ½. Brentford old was active at from 245 to 247, ditto debenture made 102½, Bournemouth preference fetched 15 5/16, Brighton original 223, Hastings 3½ per cent. 97, and West Ham 104½ and 104¾. The Continental Gas Companies were rather quiet. Imperial lost a point at from 170 to 172, Union was down at 117½, and European was not dealt in. Cagliari rose 1. Among the undertakings of the remoter world, Buenos Ayres marked 11⅛ and 11 7/16, ditto debenture 95, River Plate from 12 15/16 to 13⅛, San Paulo 12⅞, and Monte Video 11⅝ and 11¾.

ELECTRIC LIGHTING MEMORANDA.

Unhappy Position of Affairs Electrical in London—Then and Now—Defective Electric Lamp Causes Death—A Life for a Joke—Incremental Costs for Public Lighting.

The electricity question in London is in an unhappy position. No matter what is done, there arises strong opposition from one or more quarters. This is due to two causes. One, the fact that politically Westminster and Spring Gardens have for years, with a single short interruption, been antagonistic. When there was a Conservative Government in power, the Progressives were in the ascendant in the London County Council; when, during 1906 only, the political colours of the Government and of Spring Gardens matched, there was every prospect that the County Council would shape the electricity supply of London after their own heart's desire. Then came the great eviction at Spring Gardens; and politically the Government and the County Council were again at variance. That is one cause of the present unhappy position; the other is that the existing electricity distributors in London cannot be reconciled to the idea of giving up any part of their rights. The majority of Moderates now on the Council who are curtailing the extraordinarily comprehensive Bill that they inherited from the defunct Progressive majority, is too strong for even the Government to go to extremes with. Evidence has shown itself on the surface that the Government are willing to travel a certain length with the new and powerful County Council in carrying the modified Bill; but at that certain stage, it is intended by the former to fence in the latter with such limitations that the electricity supply of London cannot possibly escape from the trammels of close municipal supervision and control. The resumption of the debate in the House on the Bill was due, according to arrangement made before the Whitsuntide recess, for last evening; and in anticipation, Mr. Lloyd-George gave notice of a motion having for its object the insertion (if the Committee to which the Bill will be referred finds the preamble proved) of provisions limiting the purposes of the Bill to the enabling of a Joint Committee to be formed under the Bill to enter into, and to carry into effect, any agreement which may be made between the Joint Committee and the County Council under any Act conferring powers of electricity supply on the latter. However, after all that is being done in the way of modification by the County Council, the Borough Councils who own electricity undertakings are not of one mind as to the propriety of supporting the Bill. For example, a Special Committee of the Stepney Borough Council have gone to the length of a conclusion that the amendments in the Bill have in them no promise of better conditions than those foreshadowed in the measure as originally introduced, but are, on the contrary, calculated to aggravate the danger should the Bill ever become law. The Borough Council are therefore going to prosecute their petition against the measure in both Houses. Looking at the Bill in its one form and at the Bill as it is now proposed to modify it, we cannot accompany the Stepney Council in their conclusion. On the other hand, the Shoreditch Borough Council have called a conference of representatives of the Councils with a view to endeavouring to make some arrangement with the County Council to safeguard the interests of the municipal electricity undertakings. But whatever happens in the future over the electricity supply of London, it is fairly certain that a great deal of good money will be wasted before things settle down again to a normal condition; and then will the shareholders and ratepayers or the electricity consumers be the sufferers? Higher prices, electricity cannot stand; and therefore the prospect for investors in electricity supply in London is not brilliant.

The reduced profit-earning capacity of the Metropolitan Electricity Companies—through competition, heavy rates, and higher administrative expenses—has been previously referred to, and has been the subject of comment at the meetings of the shareholders. But as the matter is spoken of year by year, and comparison is only made with the year immediately preceding, the full import of the effect that adverse influences are having is not borne to mind. The "Electrical Times" has published a summary of the principal financial records of the St. James' and Pall Mall Electric Light Company and of the Westminster Company from their start; and, so presented, the figures do not look exactly encouraging. Wealthy though the district of the St. James' Company is, 14½ per cent. though the dividend was for a period of eight years, the Company's ordinary dividend is now limited to 10 per cent. It is seen that the gross profit last year was £52,265; in 1905, it was £55,292; 1904, £61,921; 1903, £62,237; and 1902, £65,283. Since 1902, therefore, the gross profit has been sliding away; and we have to go back to 1900 to find the equal, or thereabouts, of last year's gross profit. In that year, the amount was £52,011. In 1900, the capital outlay was £390,231; and last year £429,395. In 1900, the surplus was £37,646. For the next four years, it was only once a few pounds under £36,000; in the other cases, from £147 to £632 over the £36,000. In 1905, however, came the big drop to £29,744; and in 1906 to £25,851. The figures tell a tale—one point in it being that on the lower capital of 1900, the Company were earning an amount of gross profit equal to last year, and had a considerably larger surplus. It must be recorded to the credit of the Company that, through their best and worst years, depreciation has never been neglected, though the 3¼ per cent. set aside last year is a falling off from the best figures. In the case of the Westminster Company, the gross profit last year was £119,094; but that is a considerable decline from the record figure of two years ago—viz., £137,747. Substantial progress was made by the Company between 1901 and 1902—the gross profits for the two years being respectively £86,687 and £116,210. In 1903, the gross profit was £123,786; in 1904, £137,747; 1905, £124,285; and (as mentioned above) in 1906, £119,094. The surpluses have also fluctuated, and are now far from their best. In 1902, the sum was £72,769; in 1903, £78,201; 1904, £84,221; 1905, £69,473; and 1906, £72,548. The capital outlay has also seen some heavy increases; being last year £1,081,130, as compared with £855,793 in 1901, and £901,807 in 1902. Depreciation has not been quite so handsomely dealt with as in the case of the St. James' Company—the average being 2·83 per cent. The amount set aside last year was 2·73 per cent.; but in certain former years 3·56, 3·52, 3·40, and so on are noticed. It is remarked, as a commendable feature of this Company's finance, that a large proportion of the reserves are made productive outside the business; and the funds are given the credit of the interest upon the investments. The figures show plainly how large has been the loss of elasticity as profit-making concerns of these two Companies.

Peculiar are some of the fatal accidents that we hear of in connection with electricity supply. Here is one, the facts concerning which came out at an inquest. The unfortunate man who lost his life was William Tomalin; he was a stoker employed at the South-Eastern Hospital in the Old Kent Road; and he met with his death merely through a defective electric lamp. The simple facts were these: The engineer (wanting more light on a job on which he was engaged) asked Tomalin to bring to him an electric lamp that was suspended from the ceiling of the room by a hook. Tomalin went up a ladder to a platform to obtain the lamp; and the next the engineer heard was a gurgling sound. Turning round he saw the unfortunate man on the platform on his knees. Deceased was brought to the floor; but on a medical man arriving, life was pronounced extinct. All that could be found wrong with the lamp was a slight leak. The engineer-in-charge described what he could feel on applying his finger to the spot as nothing more than a pin prick. Slight shocks had been experienced from the lamps on previous occasions; but nothing serious. The lamp (which had only been in use about four or five weeks) and the wire were insulated. The medical superin

tendent attributed the cause of death to syncope from electric shock; and the jury returned a verdict accordingly. The only use that we desire to make of this lamentable occurrence is to point how, in electricity supply, a small defect will sometimes produce large, disastrous, and painful consequences. One other illustration. Electricity is not a fit thing to use in perpetrating practical jokes. A young married man lost his life quite recently through an electric shock received from a wire which had been connected, for a practical joke, with the inside handle of a door of an engineer's shop at Sheffield. Death, it is reported, occurred ten minutes after the shock. These instances of death from electric shock, evidently on systems using quite ordinary voltages, carry their warnings as to danger, and show how necessary it is for just as much care to be exercised with electricity supply as with leakages of gas, trouble through which is mostly preventable, if the caution that smell gives were not neglected.

Some time ago the Hastings Town Council had to face the rebuff of the rejection of a scheme for extending electric lighting to certain streets, on the ground that the case for the contemplated additional expenditure was not satisfactory from the point of view of economic administration. The Public Lighting Committee have now carried in the Council a more modest scheme, which does not come directly before the ratepayers, as the Council, without so much as saying "by your leave," have decided to displace certain gas-lamps, and put up eight flame arc lamps at a cost of £27 each, the total of which—£216—is to be paid out of the rate account, and be spread over a period of three years. The sum is not a large one; but it shows how easily a local authority can remove any obstacle to the consummation of their spendthrift will. Little by little, they can effect any object that, when viewed in its entirety, commonsense declares is unnecessary; and the ratepayers have eventually to pay dearly for the Council's obstinacy. The first cost of these eight lamps does not constitute the whole of the story. The gas-lamps that will be displaced only cost £75 8s. per annum; the eight flame arc lamps—for current, carbons, trimming, and extinguishing—will cost £20 each per annum or £160; and this is without calculating anything for capital charges and depreciation. Step by step the public lighting bill mounts up; and only because the Council are themselves the purveyors of electricity. The Hastings Council will perhaps console themselves that theirs is not a solitary example of municipal stubbornness in extravagant doing for the sake of a concern which their hallucination of a few years ago brought upon the town.

PERSONAL.

Mr. W. R. WILSON, who has been Assistant Manager in the Colne, Warrington, and Banbury Gas-Works, has been appointed Manager of the gas and water works of the Kendal Corporation, in succession to Mr. William Thomson, who, as recently announced in the "JOURNAL," has obtained the position vacated by Mr. T. N. Ritson at Ramsgate. Mr. Wilson is the son of Alderman Titus Wilson, of Kendal.

The position of Engineer and Manager to the Ilford Gas Company, rendered vacant by the removal of Mr. A. A. Johnston to Brentford (as recorded in last week's "JOURNAL"), has been filled by the appointment of Mr. W. B. FARQUHAR, who has been for the past four years Assistant Manager of the works. Mr. Farquhar served his time under the late Mr. Jesse Hall at St. Andrews, and subsequently held positions in the Leith Works and Edinburgh Works under Mr. W. R. Herring.

Connecting a Gas-Main while in Service.

An interesting piece of engineering work has just been successfully carried out at the Sowerby Bridge Gas-Works, by Messrs. John Ruscoe and Co., of Hyde. It was a question of putting a new governor upon the 18-inch main leading from the principal gasholder; and, under ordinary conditions, this would have necessitated throwing the main out of use. The job was, however, carried out without stopping the supply of gas or even lowering the pressure. It was done in the following way: A cast-iron jacket was fixed round the main, and caulked so as to make a thoroughly gas-tight joint. To the jacket was attached an 18-inch gas-valve; and the heavy portable drilling apparatus being fixed in position and firmly bolted to the valve flange, the gas-valve was opened to allow the cutter to advance, and was brought in contact with the pipe to be drilled. The operation of cutting the piece out of the pipe was performed by two men; and though the full supply of gas was on, it was not interfered with, nor was any lost by leakage. Owing to the peculiar shape of the cutter used, which resembled a cup, the piece taken out of the gas-main was gradually forced up into the cutter; and when the operation was finished, it was withdrawn through the valve without the slightest difficulty—leaving a clean-cut hole of full diameter. As the piece and cutter were withdrawn, the valve was closed down, and everything was ready for connecting the branch pipe. As previous operations of this kind had been carried out on mains of only 6 inches diameter, the firm made special appliances for the task, which they accomplished to the entire satisfaction of the Gas Engineer to the Urban District Council (Mr. Arthur W. Bissell).

ILLUMINATING TRUTHS FOR TRADESMEN AND OTHERS.

(6)

ON SHOP LIGHTING, WITH PARTICULAR REFERENCE TO THE ELECTRIC FLAME ARC LAMP.

To the shopkeeper the question of lighting his business premises is one of immense importance. He has part and lot in the common experience, in the fight for existence in the commercial and professional worlds, that increasing competition and expenses have eaten deeply into the old rates of profit and remuneration for services rendered. Consequently, on the one hand, tradesmen do not want to unnecessarily increase expenses; on the other hand, they desire to make an impression so as to draw as much custom as possible. There are right and there are wrong ways of making an impression; for some of the wrong ways will merely have the diametrically opposite effect to that intended, and drive custom to competitors. Big lights and big prices for goods will not draw; the man with low prices for good-quality articles and with a poor light will do much more business. But the man with well, but not over, lighted premises, with prices low and the quality of commodities good, is likely to do still more. His is the shop that will attract; for it is a mistaken notion that big lights are paramount in the considerations affecting success in trading enterprise.

Some shopkeepers in recent times have thought that the proper thing to do is to imitate the cheap-jack, and present a gaudy exterior to the public; but by the means adopted in many instances the appearance of the goods in the windows are vastly deteriorated. This is one of the results of believing the declaration of the electrician that "the best, the cheapest, and the most brilliant light for advertising purposes is obtained by the use of flame arc lamps." This statement will be disproved in the course of this article, and largely out of the mouths of electricians. It has not missed observation that the electrical industry has lately been making bold efforts to secure the shop-lighting business; using flame arc lamps as the lever. The increased activity is due no doubt to the fact that electricity consumers are finding that the value of electric lighting—intrinsic and monetary—is not all that has been represented. There are tradesmen who rue the day they were "off with the old love, and on with the new." The new one has proved not only expensive, but "fickle as a changeful dream."

The Requirements.

For shop lighting—both exterior and interior—a good, but not dazzling, light, uniformly distributed, is required; as money saved means money earned, a cheap light (so long as it is good) is necessary; it is highly important that the light should be reliable, and not prone to sudden collapses, leaving the shopkeeper's goods at the mercy of light-fingered gentry, and causing loss of trade; and the means of lighting should be one which, exercising care, is safe. Concerning these various matters, it may be suggested that the leaflets Nos. 3, 4, and 5, dealing respectively with "Fire Risks," "The Relative Cost of Gas and Electricity," and "Reliability, with Instances of Misplaced Confidence," should be read in conjunction with this one. [If these numbers are not at hand, the local gas office will be pleased to supply them to any shopkeeper making application.] The tradesman requiring a good, safe, and reliable light will, after reading these leaflets, have been primed on many matters affecting these questions that naturally would not come to his knowledge without having the information brought specially before him, or without paying too dearly for the experience. There is not the slightest reason, however, why anyone should now take a leap in the dark in connection with artificial lighting. It is because so many shopkeepers have done so, because so many have gone to considerable expense in installing electricity, and have afterwards found the total annual expenses also great—much greater than in days of incandescent gas lighting—and yet no equivalent has presented itself in the way of additional business and profit, that there has been dissatisfaction and grievous disappointment. Where, it may be asked, is the sense of going to greater expense for lighting, if business is not benefited? In incandescent gas lighting, improvement has not stood still; and, both for interior and exterior shop lighting, the advantage of greater efficiency for the gas consumed can be obtained without additional annual expense, and supplementing cheapness are reliability and other favourable considerations. For outside lighting there is a great range of types of lamps offering—such as high-pressure lamps, self-intensifying ones, and lamps with clusters of burners (both upright and inverted), and for interior lighting there are the ordinary and inverted burners in great variety.

Advertising Value of Flame Arcs an Illusion.

It is, as has already been suggested, one of the greatest illusions of recent times that it is necessary for a tradesman to have in front of his premises dazzling flickering lights such as those of electric flame arc lamps. They are a perfect nuisance and a great discomfort to pedestrians hung at the low level requisite if they are to have any effect in throwing light upon the goods displayed in the window; and to so hang them is an act of selfishness and an abuse of liberty. The lights attract from a distance, but on closer acquaintance they repel by the injurious straining

and irritating effect they have upon the eyes. It is a senseless proceeding to attract to the shop window, and then prevent proper inspection by the excessiveness of the lighting. Shopkeepers using flame arc lamps have been told by customers that it is a matter of impossibility to inspect the goods in their windows if they are blinded by the use of jumping lights, of such concentrated brilliance; and it is equally impossible to properly judge colours by them. The result is that likely customers are driven from the window with the dazzling lights to windows that are illuminated in a more rational way, and with some consideration for the comfort of people using the streets. What is the good of a window in which to display goods, if, by the system of lighting adopted, people are precluded from making proper inspection? The fact of the matter is the flame arc lamp is a highly concentrated light, by which, as Mr. H. S. Hatfield, B.Sc., recently said in the "Electrician," "a certain illusory efficiency is gained by the unequal distribution of the light."

The local electrical canvasser, and the electrical engineer in his circulars, say nothing about these things, but they laud extravagantly the advertising value of the flame arc lamp. The opinion of the canvasser and the electrical engineer is not endorsed by two of the technical organs of the electrical industry. Compare what is said locally with these extracts from those papers:

The "Electrician" on April 12 said:

The average shop window is often still an eyesore, though some improvement has been brought about by reflector-shades, and by the use of concealed lamps. ***Many shopkeepers seem to regard the public as a swarm of moths, and thus give as dazzling a supply of light as they can afford—much to the discomfort of those who proceed to take a nearer view of the display.***

The "Electrical Times" of April 4 said:

The existence of large flame arc lamps along the kerb detracts very much from the advertising value of a well-lighted shop window. ***It is an exploded notion that a blaze of light, without anything to shine upon, attracts business. It merely attracts moths and loafers.*** **A glare along the edge of the pavement often cuts off the view of a well-appointed shop window.**

It will be seen from this that among electrical experts, there is not common belief as to the advertising value of very high-power sources of lighting outside shop windows—especially such unsteady sources of illumination as flame arcs. If, however, a tradesman believes in high-power sources of illumination (and everyone has the right to his opinion), then by the aid of high-power incandescent gas-lamps, of which there are many types—

A light of great intensity can be obtained.
A light that is cheap.
A light that will not fail.
A light that will not flicker, and distress the eyes of those inspecting the goods in the window.
A light that will exhibit goods in their true colours; and therefore
A light by which various colours can be safely matched.

Consumption and Efficiency.

The electrician will tell the tradesman that candle power for candle power the flame arc lamp is the cheapest source of illumination extant. That is a statement that requires to have brought upon it several considerations which are not, to his ultimate disadvantage, usually paraded before the would-be user. The tradesman does not want to know anything about horizontal or spherical illuminating powers; nor how much lighting is going to cost him, according to the readings of the photometer (the instrument by which light is measured), per candle power per hour. He wants to know what an amount of useful illumination, sufficient for his needs, is going to cost him. With flame arc lamps, there is a great deal of wasted illumination that has to be paid for; the practical, commercial man only requires to pay for light that is *effective* and *useful*, and not that which is of no value to him. Electricians are diffident about talking of the total costs of flame arc lighting; but we know that for street lighting, the charge for each lamp is anything between (say) £13 and £20 and upwards, and for street lighting, as a rule, a lower charge than for shop lighting is made per unit for electricity, and the flame arc lamps are generally extinguished about midnight. In Oxford Street, the cost is nearly £21 per lamp per annum without reckoning anything for capital expenditure, and half the lamps are extinguished at midnight. Some flame arc lamps are credited with a consumption of 350 watts per hour each; others run much higher. But taking the low figure of 350 watts, it means that each lamp will consume a unit of electricity every three hours. The tradesman will be advised that he should have two, four, or more lamps, and not one. So that, if he has two flame arcs of the type using the previously-named low (low for lamps of the arc type) quantity of electricity per hour, he will absorb two-thirds of a unit of electricity per hour; if he has four lamps, close upon one-and-a-half units of electricity will be registered against him in an hour. The shopkeeper would do well, if he wants flame arc lighting to get a price from the electricity undertaking per lamp that will include carbons and maintenance; otherwise, according to the writer's experience, the cost at the end of the year will cause the tradesman some little astonishment.

The light obtained is, as already said, a highly concentrated and unsteady one; and the light is not well distributed. Look at samples that may be fixed in the district; and it will be found that the bulk of the light is confined to a circle beneath the lamp. An American lighting engineer has likened this to the effect that would be produced by turning a railway engine's head-light face downwards. It is the acuteness of the angle below the horizontal of the greater part of the light rays which necessitates these lamps being hung at a height, in order to secure the best illuminating effect and distribution from them, and prevent them from affecting the eyesight of pedestrians and possible customers. And the greater the distance from the source of illumination to the point where the light is required, the greater the waste of illumination. From this, it will be seen how much waste of illumination there is; and therefore how fallacious is the statement of the electricians as to the cost per candle power per hour, in view of the fact that that cost is not calculated on the effective or useful candle power, but on the total candle power including that which is not useful. More useful illumination, and less waste of money, can be obtained by having smaller units of light. It is not a good system of lighting to have an immense amount of illumination from one large centre.

High Supplementary Expenses.

The consumption of electricity is not the only expense attached to flame arc lamps. Those tradesmen who make up their minds to adopt these lamps must not be misled into expecting that that is the only cost. If they do, they will not be long deceived. The initial capital cost of these lamps is not a light sum. In them, chemical carbons are used; and these are more expensive than the carbons employed in the ordinary arc lamp, and their life is very short. The chemical carbons give off fumes which obscure the globes (so causing loss of light), and produce great deterioration of the mechanism and metal parts of the lamps. The wear and tear upon the lamps is also great. Therefore, the expenses of these flame arc lamps involve—

First cost.
Cost of electricity.
High cost of short-life chemical carbons.
Labour required for frequent attention and renewal of carbons.
Wear and tear on lamps from the injurious action of the fumes arising from the burning of the chemical carbons; and therefore the
Cost of repair and replacement.

In some cases what are known as magazine lamps are used for the carbons, in order to save some of the expense of labour in carbon-renewal. But these magazines only cause additional complication of the mechanism, do not enhance reliability, but certainly increase the parts for the fumes evolved to exercise their deteriorating influence upon. The fumes it should be added render the lamps undesirable for indoor use. All these various points were confirmed in a paper by Mr. Leonard Andrews read before the Institution of Electrical Engineers in 1906.

In the article in the "Electrician" already referred to, Mr. H. S. Hatfield states that the difficulties before the electrical industry in perfecting flame arc lighting are—

(1) The rapidity of the consumption of the flame arc carbon, as compared with the carbon in an ordinary type lamp.
(2) High prices and considerable fragility of carbons impregnated with metallic salts.
(3) The copious evolution of metallic salt from the carbons from their burning, which endangers insulation, causes clogging of the mechanism and increased friction, and sometimes prevents half-burnt carbon ends making contact on switching on.

Real progress should always be towards greater efficiency by simplification; otherwise the greater efficiency may be discounted by the extra expense occasioned by the elaboration necessary in order to produce the additional efficiency. That is what has happened in the case of the flame arc lamp; and therefore it may with much confidence be maintained that the flame arc lamp is not a good investment for shopkeepers. As a matter of fact, electricians are doing a great deal of injury to their own business by recommending these lights. The lamps please at the start, so long as the novelty endures; but there is often after-disappointment on the part of tradesmen who adopt them.

There is another point that is often lost sight of. If these flame arcs with their highly concentrated illumination are erected for outside shop lighting, it will not do to have a poorly lighted interior. The customer who has been trying to examine the goods displayed in the window under the downward flood of flickering light enters the shop with strained eyes, and finds herself or himself totally incapacitated from properly examining the articles shown by the feeble lights of the low candle power electric lamps used inside. The use of excessively high-power lights outside must, therefore, lead to an increase of illumination inside; and thus additional expense is created all through the establishment.

Outside Lighting in Foggy Weather.

There is one other point about the electric light; and it is its indifferent penetrating power in fogs. This is a matter of importance to shopkeepers who adopt electricity in the belief that it has an advertising value. What is true at sea, is true on land. Expert trials at the South Foreland years ago, demonstrated that in fog, the electric light has not the penetrating power of gas and other lights; and during the official inquiry at Liverpool in April

last into the loss of the White Star liner *Suevic*, Captain Murray, the marine expert of the White Star line, confirmed this. He said that he had seen the Lizard electric light obscured by fog when he could discern lights on the shore at about the same level and distance. Mr. John M'Lellan corroborated this point. Mr. J. W. Edmundson, a nephew of the late Mr. John R. Wigham, contends that the wreck of the *Suevic* has demonstrated the truth of his uncle's contention that electricity as an illuminant is not to be compared with gas or oil when the weather is foggy. The application of this testimony to outside shop lighting is evident. It is in the winter and not in the summer that outside shop lighting is required for the longest hours and under the worst conditions; and therefore expensive electric arc lights—ordinary or of the flame arc type—are even more wasteful, in view of their reduced efficiency as light-giving agents, just at the time when they are most needed.

High-Power Gas-Lamps.

Arc lights are out of the running when compared with the modern types of high-power incandescent gas-lamps; and this is true whether we look at cost, efficiency, useful light, or reliability. High-power gas-lamps can now be obtained which will give an efficiency of from 30 to 35 candles per cubic foot of gas consumed —that is to say (taking the lower figure), if only 10 cubic feet of gas per hour are used a light of 300 candles can be obtained, and a light of about 1000-candle power can be realized by using 30 cubic feet. This is not the best that can be done per cubic foot. There are the high-pressure gas systems, which can be adopted for large establishments; but we are confining ourselves here to ordinary shop lighting. Compared with flame arc lamps, these high-power gas lamps, burning on the ordinary gas pressure, are inexpensive, are easily kept clean, require no skilled person to maintain them in order, the illuminating power is sustained by a little periodical attention to the burners, and there is really nothing to get out of order. One of these lamps will outlive several flame arc lamps, the cost of mantles is inconsiderable compared with the cost of renewing the chemical carbons for electric flame arc lamps, and the mantles do not require renewal so frequently as chemical carbons. These high-power incandescent gas-lamps do not flicker; their light is not the highly concentrated light of the flame arc lamp; and it does not strain or weary the eyes of inspecting, possible customers. High-power incandescent gas-lamps are now constructed in many different styles, so that their illuminating power can be utilized in any direction, according to requirements. They can be had to give a good general illumination; by the inverted type, a good downward light; or, by the aid of reflectors the whole body of soft light can be concentrated upon the goods in the window.

A Practical Test.

Interesting testimony bearing upon the point of cost comes from the Sunbeam Motor Company's works at Wolverhampton. For new works that the Company have erected, those in authority were wavering as to the kind of light to adopt. They heard the claims of the local electricians and of the local gas manager. They heard, too, of candle powers. But they determined to put all these matters on one side; and make a practical test on their own account. Two so-called 500-candle power electric lamps, and two 300-candle power incandescent gas-lamps, were set to work to do their best for sixty hours. Gas came out more than conqueror. In the sixty hours, the two 300-candle power lamps consumed 1200 cubic feet of gas, costing, at 2s. 6d. per 1000 cubic feet, 3s., and 49 units of electricity were used by the two electric arc lamps, which, at 3½d. per unit, cost 14s. 3½d. It was also found that, apart from cost, the light of the incandescent gas-lamps was preferable. This is a common enough experience; but it is the complete independence of the testimony that is of value here. It shows the cost of gas and electricity alone, without the other expenses of maintenance—of mantles or carbons, of labour, and of wear and tear. Look well at the figures just quoted, and at the large margin, and also consider the points previously made in connection with the supervening charges. Which class of lamp takes the lead in economy and practical utility?

Inside Lighting.

Going inside the shop, it can again be claimed that in ordinary and inverted gas-burners, large and small, a very effective, practical and decorative, cheap, and reliable system of lighting can be arranged under any set of circumstances—the total costs coming out, for the service rendered, far below those that would be incurred by adopting electricity, whether using carbon filament lamps or the higher efficiency lamps, the restrictive demerits of which are not counterbalanced by the single merit of greater efficiency. But to deal with the interior lighting of shops here would only be to traverse again the ground covered by leaflet No. 4, to which those interested in the subject may be directed for serviceable information.

As was said in the early part of this article, no tradesman wants to incur additional expenditure without seeing something tangible in return in the shape of additional profit; and in the lighting of shops as of other places, there is a line dividing excess from sufficiency, a line dividing extravagance from economy and efficiency. A sufficient amount of illumination, it is claimed, can be obtained most economically and reliably by means of incandescent gas-burners, of which there are now numerous types; and advice on the subject will be readily and willingly given on application at the gas office.

THE ROAD-TARRING COMPETITIONS.

THE competitions which the Roads Improvement Association are promoting for the best tar-spreading machine and the best preparation of tar for road purposes, were begun last Wednesday.

The Association are acting, in this matter, on behalf of the Royal Automobile Club and the Motor Union of Great Britain and Ireland, which bodies are defraying the very considerable cost of the competitions. The main competition is for the best mechanical appliance for the effective distribution of tar upon road surfaces. Experience has demonstrated that the cost of sweeping a road 8 yards wide, brushing hot tar into it by manual labour, and sanding the tarred surface, amounts to about £60 per mile per annum over a period of three years. Of this cost, labour is by far the chief item; and it is hoped that a mechanical apparatus will be found which will spread the tar more cheaply and more effectively than is at all possible by hand work. The economy which should thereby be achieved would admit of a great extension of the application of tar to road surfaces. Indeed, the statement is made in the prefatory remarks to the official programme of the present competitions, that there are over 20,000 miles of main roads in England and Wales; and it is anticipated that at least 10,000 miles of these roads will be rendered dustless next summer. The extensive application of tar which is here foreshadowed depends on the discovery of easy and cheap means of applying it to the roads; and obviously gas undertakings seeking to benefit by the new market for tar thus created are directly interested in the development of a good tar-spreading machine. Of secondary importance only, though not included in the scope of the present competitions, is the discovery of economical means for coating the tarred surfaces with sand or chips as rapidly as the tarring is done. It was apparent, as the trials proceeded last week, that the limit to the amount of road which could be treated in a given time was not the capacity of the tar-spreading machine, but the rate at which the gangs of road-men could distribute sand over the tarred surface. It should surely be possible, by means of a sand-distributing machine, to effect a great economy in labour, and to ensure uniform and rapid sanding of the road. The question whether an interval of time, more or less extended, should elapse between the tarring and the sanding processes, is not, of course, affected by the means used for carrying them out.

THE MACHINE COMPETITION.

The programme of the trials of the tar-spreading machines entered for the competition was an extensive one, to which Wednesday, Thursday, and Friday last had been allotted; but owing to unfavourable weather interruption occurred, and it was only partially carried out last week. It is intended to complete the trials on the first dry day this week. The machines were to have been tested on three types of road:—

(*a*) The macadam (granite) road between Hounslow and Staines.
(*b*) The flint road between Twickenham and Kempton Park.
(*c*) The gravel road between Virginia Water and Reading, in the neighbourhood of Ascot.

Up to the time of writing, the machines had not been tried on the second type of road (flint); and portions of the Ascot (gravel) road scheduled for treatment had not been dealt with. Eight machines had entered for the competition; but of these one had failed to come to the trials. Instead, a machine belonging to the Gaslight and Coke Company, though not entered for the competition, was allowed to show its capabilities. The machines, in the order in which they were tried on quarter-mile stretches of the Hounslow and Staines road, may be briefly described, commencing at the Hounslow end. The actual point, near Hounslow, at which the treatment started, was the bridge over the River Crane, known as Baber Bridge.

THE EMULSIFIX.

The machine tried on the first section is known as the Emulsifix, and was entered by Emulsifix Limited, of Manchester. It aims at emulsifying tar-oils with water, by means of quickly whirling blades in a mixing-box, and pressing the emulsified tar-oil through a pipe on to the roads. The water is said to evaporate and suck into the road, leaving the tar-oil as a road binder and dust preventative. This machine was not spreading the ordinary tar supplied to the competitors, but a preparation of tar-oils, which smelt strongly of blast-furnace products.

AITKEN'S PNEUMATIC TAR SPRAYER.

The second section was allotted to Aitken's Pneumatic Tar Sprayer, entered for the competition by Mr. T. Aitken, of Cupar, Fife. This machine contains a pump by which air is pumped into an air-receiver to a pressure of 100 to 150 lbs. per square inch, and a pump by which tar is pumped into the receiver until the pressure reaches 150 to 250 lbs. per square inch. The tar is discharged under this pressure through spraying-nozzles on to the road. The machine was primarily designed for the spraying of refined coal tar or similar material in the cold; but a system of steam coils, fixed in the tar-tank, and supplied from the steam-waggon, enabled it to deal with the crude gas-tar supplied to the competitors. The special aim of the machine is the forcing of the tar in a highly diffused state into the body of the road in a

uniform manner; and the great pressure employed is intended to ensure effective penetration.

Johnston's Lassailly Tar Road Binder.

The third section was apportioned to Johnston's Lassailly Tar Road Binder, entered by the Company of that name, of Westminster. This apparatus comprises a heater, into which tar is transferred by means of a vacuum created therein by steam, and is heated to about 209° Fahr., and a spreader to which the tar is transferred while hot and distributed on, and brushed into, the road. While the spreader is discharging its contents, another charge is being taken in and heated, so that the operation goes on continuously. The machine is designed to deal with ordinary gas-tar, and in the trial used the crude tar supplied to competitors.

Tarspra Machines.

The next three sections of road were allotted to three different types of machines entered by Tarspra Limited, of Westminster. These machines differ from one another only in size and mode of traction. Each comprises a tar-tank from which tar is pumped through pipes to atomizing nozzles at the rear of the van, through which it is sprayed on to the road. The tar is ejected through the nozzles under a pressure of 200 lbs. to the square inch; and provision is made to return liquid to the tank when this pressure is reached, so that tars of varying viscosity may be dealt with. One type of machine is of 700 gallons capacity, and is mounted on a Thornycroft motor-van; another type is of 1000 gallons capacity, and is drawn by a tractor attached to the front of the van; while the third type is of 200 gallons capacity, and is intended to be drawn by a horse. These machines used the crude gas-tar.

Thwaite Anti Road Dust System.

The next section of road was allotted to the Thwaite Anti Road Dust System, entered by Messrs. Thwaite and Thorp, of Westminster. The machine comprises a boiler, in which tar is heated under an air or steam pressure of 5 to 10 lbs. to the square inch, and is forced by the pressure on its surface through fine nozzles on to the road. The inventors prefer to heat the road surface by means of a hot roller immediately before tarring, then to spray it, and cover with heated sand. The tar, if dehydrated, is sprayed by air-pressure; but if otherwise, by gaseous or steam pressure. The machine used the crude gas-tar supplied for the purpose of the competition.

Reeson's Oil-Gas Tar Sprayer.

The final section of road was treated with oil-gas tar, and partly with coal-tar, by a machine devised by Mr. J. N. Reeson, the Engineer of the Beckton station of the Gaslight and Coke Company, for spraying oil-gas tar in the cold. The tar was distributed through nozzles on to the road, and brushed into the surface by two rotating circular brushes attached to the back of the cart. The machine had been brought to the scene of the trials apparently merely to apply oil-gas tar, which had been entered by the Company in the competition for the best preparation of tar; but space being available owing to the default of a competing apparatus, it was allowed a more extended trial as a machine. It probably was not intended, in its present form, to deal with so highly viscous a material as crude coal-tar; but for spreading the thinner oil-gas tar it was eminently satisfactory. Striking features of this exhibit were the beautiful team of shire horses drawing the cart, and the perfect organization of the staff in attendance. Notwithstanding that the competition for tar preparations was limited to one day, Mr. Reeson was present, and his machine was at the disposal of the Association throughout the three days on which the competing machines were tried. The Company had apparently provided a large supply of oil-gas tar; and portions of the Ascot road were also treated by them with it.

The Trials.

So much for the machines, which on Friday were also working on specified stretches of the Ascot gravel roads. The machines, generally speaking, worked well on Wednesday and Thursday on the macadam road to Staines; but on Friday some were in difficulties, owing apparently to the highly viscous character of the crude tar supplied at Ascot to the competitors. This tar had been obtained in tank-waggons from the Reading Gas-Works. It transpired that the tar supplied to the machines on the Hounslow-Staines road had been secured from the South Metropolitan Gas Company; and it seemed to be less viscous than the Reading tar. As to the merits of the performances, it is impossible as yet to offer any opinion of value, owing partly to the trials not being completed, but mainly to the fact that, under the rules of the competition, the efficiency of the application will be judged from the penetration of the road, the equality of the distribution, and the quantity of tar which the road is forced to absorb. On these points, information is needed which can only be possessed by the officials, and is not likely to be divulged until after the judges have made their award.

Competition for the Best Preparation of Tar.

The competition for the best preparation of tar for road purposes, though described as subsidiary to that for the best spreading machine, is perhaps of greater direct interest to gas men. According to the official memorandum, "the chief object of the competition is to ascertain the cheapest method, consistent with efficiency and effectiveness, of treating crude tar—not necessarily the distilled or refined article—to make it suitable for use upon the road." It is evident that, assuming that the tar in question is gas-tar, the framers of the memorandum had in mind some simple mode of treating tar which could be carried out at any gas-works and would give a better material than the untreated tar for road use. There is no doubt also that gas-tar only was in contemplation at the time the memorandum was drafted; but the competition has brought out as heterogeneous an assortment of preparations as could well be imagined, and in some cases tar of any kind seems to be an almost negligible constituent.

Nine preparations have been entered for the competition; and they were tried, together with three kinds of tar which the Judges' Committee had decided to experiment with, on a stretch of the Hounslow-Staines macadam road to the west of the stretch used for testing the machines. A section, approximately a quarter of a mile in length, was allotted to each preparation. It will be convenient to refer to them in the order of the sections of the road (commencing at the Hounslow end) on which they were tried.

Hacknite.

The first section is devoted to "Hacknite," entered for competition by a London firm of that name. The material is described as a combination of carbolic acid, oil, asphalt, tar, &c., and to be an insoluble liquid which, when sprayed on the road in conjunction with water, oxidizes.

Crempoid R and Crempoid D.

The next section was apportioned to "Crempoid R," which is one of two preparations entered by Mr. A. J. Craig, of Edinburgh. His other preparation, "Crempoid D," was tried on the section next but one to "Crempoid R;" and as the two appear to have the same basis, they may be best described together. A mixture of glue and bichromate of potash is said to become insoluble under the action of light, but to be too dear and also too brittle for use as a dust-layer. The mixture is therefore softened by the addition of oil and other matters, which produce on the road, under the action of light, a film that is ductile, plastic, and insoluble. The film is said not to soften, like tar, in hot weather, and not to be slippery. "Crempoid D" does not contain coal-tar, is miscible in water in weak solutions, and serves as a dust palliative, which may be applied from an ordinary water-cart. "Crempoid R," on the other hand, contains a large proportion of coal-tar, and is intended for application by means of a tar-spraying machine, or for amalgamating with the metal with which the road is to be made.

Ermenite.

The third section is treated with "Ermenite," entered for the competition by Mr. W. F. Ermen, M.A., of Manchester. In producing "Ermenite," cotton-seed oil is treated at an elevated temperature with sulphuric acid, and the product is purified by washing and mixed with four times its own weight of crude tar. The mixture is agitated with hot caustic soda solution until emulsified, and then diluted with water until it contains 20 per cent. of tar. The 20 per cent. emulsion is mixed with four volumes of cold water, and the mixture is intended to be applied from an ordinary watering-cart, without mechanical stirring.

[The three kinds of tar, the nature of which was not divulged, which the judges had decided to try, were to be interpolated at this point, but they were not all laid by Friday last.]

Pulvicide.

Then followed "Pulvicide," entered by Messrs. Kay Bros., Limited, of Stockport. This compound is said to be produced by mixing and melting by heat until dissolved 50 gallons of coal-tar creosote, 1 cwt. of coal-tar pitch, and 2 cwt. 1 qr. of resin, then pouring into this a solution of 28 lbs. of caustic soda or potash in 18 gallons of water. The "Pulvicide" so produced is to be mixed with water and applied by means of a water-cart to the surface of roads. The pitch or asphaltum is said to be left upon the road surface, and to agglutinate the particles when the water has evaporated therefrom.

Marbit.

The next section was treated with "Marbit," entered by Mr. T. G. Marriott, of Glasgow. It is described as consisting of crude coal tar and a specially prepared form of natural bitumen, combined when cold and immediately before application to the road. The mixing only shortly prior to use is regarded as being essential, in order that the atmosphere may effect the requisite changes for the proper setting of the material. It is intended to be applied in the same manner as crude coal-tar.

Oil-Gas Tar.

The oil-gas tar entered by the Gaslight and Coke Company of London is described as tar with 5 per cent. (but generally less) of water, and is to be applied to the cleared road surface by a water-cart or spreading machine.

Clare's Patent Tar Compo.

The next section was devoted to "Clare's Patent Tar Compo," entered by Messrs. R. S. Clare and Co., Limited, of Liverpool. It is described as a specially prepared tar, from which certain impurities have been extracted, treated in such a way that the tar shall be of uniform consistency in winter and summer.

Solidified Tar.

The ninth competing material was "Solidified Tar," entered by the Tar (Patents) Solidifying and Distilling Company, Limited, of London. The tar is described as merely tar solidified, minus a reduction of 4 per cent. of its constituents, consisting of some of its light oils, which are recovered and almost pay for the cost of solidification. Readers of the "Journal," however, will be

familiar with the process of solidification devised by Mr. S. G. Coulson and worked by this Company, which was described in our issue for Feb. 26 (p. 525). The solidified tar can be melted and applied as ordinary tar; but the cost of transportation is said to be much lower.

The Characteristics of the Materials.

This summary of the chief characteristics of the materials under trial indicates that the results are likely, from the comparative standpoint, to be most instructive. It is too soon yet to form any useful opinion on the relative merits of the preparations, as their value largely depends on the durability displayed by the coating and the resistance of changes of weather conditions, as well as to dust-allaying qualities for the time being. Even in regard to the latter point, the weather has not been sufficiently dry since the preparations were laid on the road for the utility of any of them to be displayed. It may be observed, however, that some of the materials entered for the competition are merely palliatives to be used as auxiliaries to the ordinary watering of the roads; that some are scarcely of the nature of preparations of tar; and that others contain only a relatively small proportion of gas-works tar. Some of the materials did not require the surface to be coated with sand after their application; but of the "tar" preparations properly so-called, oil-gas tar was apparently the only one possessing this advantage.

Regarding the materials as means of utilizing gas-works tar for road purposes, it appears that gas managers will be disposed to favour the claims of the following rather than the other competing preparations: Clare's tar compo, oil-gas tar, and solidified tar, to which should probably be added at least one of the materials introduced by the Judges' Committee. It seems likely that the cost of the materials used in the manufacture of some of the preparations will be prohibitive as compared with crude or refined coal tar or oil-gas tar. No particulars as to cost, however, have yet been published, though it is one of the considerations on which it is officially stated that the merits of the competing preparations will be judged.

How to See the Roads.

A large and distinguished company assembled at Ascot on Friday last (at the invitation of the Berkshire Automobile Club, of which Lord Roberts is President), to luncheon in the luncheon-room of the grand-stand enclosure. Major E. R. Portal, the Chairman of the Club, presided. The toast of the Roads Improvement Association was given, in a speech commendable for its lucidity and happiness of expression, by Dr. Guglielminetti, of Paris and Monte Carlo, who has been largely responsible for the extensive treatment of roads with tar in France. The road authorities of the United Kingdom were well represented, and a number of men connected with the gas industry were present, including Sir George Livesey, Mr. H. Rayner, Secretary of the Gaslight and Coke Company, Mr. J. N. Reeson, Engineer at the Beckton Gas-Works, Mr. D. H. Helps, Engineer to the Reading Gas Company, and Mr. W. E. Price, Engineer to the Hampton Court Gas Company. The tar-spreading machine trials were in progress on the main road at Ascot during the day, and much interest was taken in them by the numerous Press representatives present, and by road surveyors and engineers from all parts of the country. Unfortunately, the traffic on this road was not well controlled by the police; and considerable interference with the operations of the machines was experienced.

Anyone desirous of witnessing the effect of the treatment of the road by the competing machines and preparations can best do so by taking train to Feltham Station, and joining the main Staines road at Baber Bridge, which is a short distance from that railway station. A walk of nearly 5 miles along the road to Staines will take the observer over the whole of the macadam surface treated, and the quarter-mile stretches allotted to each machine or preparation can be readily identified by the posts of demarcation. The rail can be joined again at Staines for the return journey.

We hope to give an account next week of the operations of the competing machines on the flint road between Twickenham and Kempton Park, if the weather shall have admitted of the trials being resumed there this week.

In connection with the preceding particulars, it may be of interest to reproduce from the "Annales des Conducteurs et Commis des Ponts et Chaussées" for the current month some remarks on the behaviour of tarred roads in severe weather. Last winter was a long one, and was characterized by numerous variations in temperature. But observations which were carefully made confirmed the results previously recorded, that tarring effectually preserves a roadway. But, of course, the extent and the nature of the traffic upon it has to be taken into consideration. Heavy carts or waggons do much more damage to tarred roads than motor-cars; whereas the destructive action of the latter on roads which have not been tarred is far greater than that of the former. This is explained by the fact that disaggregation of an ordinary road surface by motor-cars is produced by suction, owing to the speed acquired; whereas on a tarred surface there is no such effect. On roads subject to heavy traffic, the coat of tar which during the summer protected the macadam, has generally disappeared after the middle of November; and, at first sight, no trace of tar seems to exist. But if the sections of the road not treated are compared with the tarred portions, it will be found that the former are very much worn—having deep ruts and an irregular surface—while the latter have retained their even surface. This is due to the fact that below the tar coating the macadam preserves its very strong adherence, due to the infiltration of the tar oils, to a depth of 1¼ to 1½ inches; consequently, on the entire surface a very resisting layer is formed, upon which the rolling stresses are evenly distributed. The road therefore wears naturally but uniformly. Moreover, during winter there is very much less mud on tarred roads than on the others. In the case of roads with average traffic, the tar often remains after the winter, and a very slight application of the material suffices to restore solidity.

As an example of what has just been stated, the road from the banks of the Seine to Billancourt, which was very satisfactory all last winter, and is still in good condition, may be cited; and also the Boulevard Maillot, which, notwithstanding very heavy traffic, retains conspicuous traces of tarring along half its length, and has a well-marked surface, though it has not been re-ballasted since 1900. This boulevard has for three years been carefully tarred by means of the Lassailly machines at the beginning of the summer, before the running of motor-cars is in full swing. In the case of nine-tenths of the roads, they might easily be preserved intact if they were re-tarred soon enough, and if, in the case of roads having but little traffic, a light half-tarring were done at the end of the season, as was the case last year in the Boulevard Maillot. An important point is that in winter tarred roads are free from ice, as water does not remain on the surface.

GERMAN GAS & WATER ENGINEERS' ASSOCIATION.

Programme of the Forthcoming General Meeting.

We have received the official programme of the Forty-Seventh Annual General Meeting of the Association, which is to be held, as already announced, at Mannheim, from Tuesday the 11th to Saturday the 15th of June, under the presidency of Herr Nolte, the General Manager of the New Gas Company of Berlin.

The meeting will open on the Tuesday with a reception in the Friedrichs Park, where a supper will be given by the local Committee. The technical proceedings will commence on the Wednesday, and will occupy the mornings of that and the two following days. Wednesday afternoon is allotted to a trip on the Rhine, and the evening to a gala performance in the National Theatre. On Thursday afternoon, the local gas-works, at Luzenberg, will be visited, and in the evening there will be an informal general visit to the Horticultural and Art Exhibition. The local water-works will be inspected on the Friday afternoon, and there will be a banquet in the evening.

The papers dealing with gas matters, which will be taken as far as possible on the Wednesday morning, after the delivery of the President's Inaugural Address, are as follows: "The Gas, Water, and Electricity Works of Mannheim," by Herr Pichler, the Manager; "The Vertical Retort Settings at Cologne," by Herr Prenger, the Manager of the Cologne Gas-Works; "Chamber Settings," by Herr Ries, the Manager of the Munich Gas-Works; "Calculating the Prime Cost of Coal Gas," by Herr E. Körting, the Manager of the Berlin works of the Imperial Continental Gas Association; "The Use of English Gas Coals in Germany," by Herr Möllers, of Cologne; "Boundary Questions for Gas-Works and New Solutions," by Herr Kobbert, of Königsberg; "Inverted Lighting, with Ignition from a Distance for Private and Public Use," by Herr Kern, of Strasburg; "Combustion Phenomena of the Inverted Gas-Burner," by Dr. H. Bunte, Professor at the Physical-Technical College at Carlsruhe; "The Supply of Germany with Carburetting Oils," by Dr. Schütte, the Manager of the Bremen Gas-Works; and "Experiences with the De Brouwer Charging and Discharging Machine," by Dr. Becker, of Frankfort-on-the-Maine.

The papers dealing with water supply will be read on the Thursday morning, and are as follows: "The Hydrological Investigation of Underground Water Areas, especially in the Neighbourhood of Mannheim," by Herr O. Smreker, of Mannheim; "The Means of Water Supply in Würtemberg," by Herr Gross, of Stuttgart; "Discovery of Sources of Water Supply of Large Towns on Scientific Lines," by Mr. W. H. Lindley, of Frankfort-on-the-Maine; "The Biology of Surface Water Wells and Springs," by Professor Kolkwitz, and "The Action of Centrifugal Pumps," by Dr. E. Kux, of Hanover. The reports of the various Technical Committees appointed by the Association will be taken, so far as time permits, on the Thursday morning and concluded on the Friday.

Manchester District Institution of Gas Engineers.—As previously intimated in the "Journal," the quarterly meeting of the Institution will be held at Leek next Saturday. According to the programme issued by the Hon. Secretary (Mr. H. Kendrick, of Stretford), the members will reach Leek just before eleven o'clock, and visit the gas and electricity works. The business meeting will be held under the presidency of Mr. W. Prince, of Stoke-upon-Trent. Two papers will be submitted for discussion—one by Mr. G. H. Niven, of Cleckheaton, on "Purification;" and the other by Messrs. R. H. Clayton, B.Sc., and F. W. Skirrow, Ph.D., on "The Estimation of Tar Fog and its Separation from Gases."

THE QUALITY OF GAS IN NEW YORK.

Important New Regulations.

Early in the present year, the New York State Commission of Gas and Electricity decided to fix limits for illuminating power and purity to be required of the Gas Companies under their regulation. Subsequently there was a meeting of the members of the Empire State Gas and Electric Association, at which it was decided to ask the Commission to receive a report from a Committee selected by the Companies. This was agreed to; and the following were appointed: Dr. Alexander C. Humphreys, President of the Stevens Institute of Technology; Mr. Alfred E. Forstall, Consulting Gas Engineer, of New York City; and Mr. R. M. Searle, General Manager of the Rochester Gas Company (N.Y.). The Committee made a number of tests, and went over the whole field to be covered by the regulations, embodying their conclusions in a report which was delivered to the Commission on the 27th of March; but permission has only lately been given for its publication. This has been done through the courtesy of the Secretary of the Association (Mr. Charles H. B. Chapin), in "Progressive Age," from which we to-day reproduce the principal portions.

Recommendations.

We, the members of the Committee appointed by the Gas Companies of the State of New York with your consent to consider and make recommendations upon the regulations providing standards of illuminating value and purity to be applied to manufactured gas sold in the State, beg to submit our recommendations and our reasons for making them.

We recommend that the standards for illuminating value be 15-candle power for coal gas, 17-candle power for gas produced by mixing coal gas and carburetted water gas, and 19-candle power for carburetted water gas; and that, in determining the illuminating value, the gas be consumed at the rate of 5 cubic feet per hour, under the conditions specified later, in the burner now used as the standard burner in London and many other English cities, and known as the "Metropolitan" No. 2 argand burner.

We recommend that the gas shall not show more than a trace of sulphuretted hydrogen when tested in the usual manner—viz., by exposing to a stream of the gas to be tested a strip of bibulous paper moistened in a solution formed by dissolving 100 grains of crystallized acetate of lead in 100 c.c. of water; any distinct darkening of a strip so exposed, as compared with a similar strip left unexposed, to be taken as indicating the presence of a trace of sulphuretted hydrogen. We recommend that no regulations be made in regard to sulphur compounds other than sulphuretted hydrogen; and we further recommend that no regulations be made in regard to ammonia.

Our reasons for making these recommendations are set forth below.

Illuminating Value.

From the gas coals now in use throughout the State of New York, we do not think it is possible for the small gas companies to make a straight unenriched coal gas that will always, or even for the greater part of the year, have an illuminating value equal to, or greater than, 16-candle power. In fact, in the case of these small companies, there will be times when the illuminating value, under the climatic conditions obtaining throughout the greater portion of the State during winter, will be little above 15-candle power, and may even go slightly under it.

Where coal gas is cheaper than carburetted water gas, it is true, as a general proposition, that the most economical gas is that which can be made directly from the best gas coal commercially available in the given locality, the cost of enrichment being greater than its value to the consumer. This holds true until the quantity of gas manufactured becomes sufficiently large to make it possible to have an auxiliary carburetted water-gas plant, the collateral advantages of which may in many cases be great enough to make the cost of enriched gas no greater than that of the straight coal gas, even though the cost of carburetted water gas itself is greater than that of coal gas by itself. This condition is not reached till the sales amount to 30 million cubic feet or more per year.

It is no doubt true that, under favourable conditions and with the better gas coals, an average illuminating value of 16-candle power can be maintained. But a standard illuminating value deals with the minimum and not the average; and it is impossible to keep a bench of retorts always in the condition required to produce gas of the highest possible illuminating value. In a large works, a number of benches will be in action at all times, and the one or two that are out of condition at any particular time might form a comparatively small percentage of the total number, and therefore the quality of the gas might not be greatly affected. In a small gas-works, however, there may be only one bench, and probably will not be more than two or three benches, in action even in winter; and trouble—unavoidable at times—with single benches, or with one of the two or three, will produce a very marked effect upon the quality of the gas. Moreover, even if the single bench is in condition to give the best results under steady working, the demand for gas is not steady; and it is frequently necessary to miss charges, and consequently to either allow coal to remain in the retorts for a period from 50 to 100 per cent. longer than the normal, or to put in charges too light for the heats. The adoption of either alternative results in a lowering of the illuminating value of the gas.

Disadvantages of Enrichment.

The only methods of enrichment that can be economically employed in a small works are those in which hydrocarbon vapours are added to the gas. If the vapours are thoroughly and uniformly diffused through the gas, these methods are satisfactory for an enrichment of 2 or 3 candles. But it is difficult to secure this thorough and uniform diffusion; and, unless it is secured, the vapour condenses when the gas is exposed to cold, and the consumer obtains practically no benefit from the enrichment. In one case that has recently come to the notice of one of the members of the Committee, a gas company were adding benzol vapour to their coal gas, at a cost of about 5 c. per 1000 cubic feet sent out, without securing any beneficial results for the consumer. As the company were making over 100 million cubic feet of gas per year, and the enrichment was a failure in summer, it is certainly to be inferred that the average small company would have no better success in winter. It therefore seems to us that it would not be wise to set the standard illuminating value for straight coal gas higher than 15-candle power; and we would expect that during the winter there will be times when this gas will be found below even this standard.

Possibilities of Carburetted Water Gas.

For various reasons, it has been the usual custom to take advantage of the possibilities of carburetted water gas, and make it of a higher illuminating value than coal gas. In the past, when high-grade oils were cheap, and it was consequently possible to maintain a high illuminating value at a comparatively low cost, candle powers of 24 and upwards were common. In the last few years, however, the price of the better grades of petroleum has risen to such a point that gas companies have been forced to have recourse to the poorer grades, from which it is impossible to make gas that will carry these high illuminating values to the consumer. Taking these facts into consideration, it would seem that the interests of the consumer were fully met without undue hardship to a gas company by a standard illuminating value of 19-candle power for a carburetted water gas, and with this and a 15-candle standard for coal gas, the logical standard for mixed gas is 17 candles.

New Standards—Mitigation of Penalty for Deficiency.

With these standards established, it is certain that for the greater portion of the time the illuminating value of the gas will be above them. It does not seem just, therefore, to subject a company to a penalty if the gas is found to be slightly below the standard on a single occasion. This principle has been recognized in the regulations adopted in London, in which penalty testing for quality and purity has been carried on since 1868, and in Massachusetts—the only State it which it is carried on over the whole State. In the case of London, the regulation is that "the average of all the testings at any testing-place on each day of the illuminating power of the gas supplied by the company at such testing-place shall be deemed to represent the illuminating power of such gas on that day at such testing-place;" but "if on any one day the gas supplied by the company at any testing-place is of less illuminating power to an extent not exceeding one candle than it ought to be, the average of all the testings made at such testing-place on that day and on the preceding day and on the following day shall be deemed to represent the illuminating power of the gas on such one day at such testing-place." In Massachusetts, the provision is that there is no penalty for a single failure; but there must be either three consecutive instances where the gas is below the standard, or there must be three instances within thirty consecutive days. It is to be noted that under the Massachusetts law the tests cannot be made oftener than once a week. We therefore recommend that, provided the deficiency shown by a test is not more than one candle, no penalty be inflicted unless the average of the results of three consecutive tests, one of which is to be the one preceding that showing a deficiency and no two of which are made less than 24 hours apart, is below the standard.

Determination of Illuminating Power.

The Committee next explain in detail the method by which the illuminating value of gas is determined. They trace the history of English legislation on the subject from the passing of the London Gas Act of 1868 down to the sanctioning of the "Metropolitan" No. 2 argand as the test-burner. They quote the portion of the "Notification" of the Metropolitan Gas Referees in which instructions are given for using this burner in making a test, and conclude by recommending its adoption as the standard burner for all qualities of gas. Dealing with the objections to the burner, they say: It may be objected that the burner recommended is not one that is used to any extent by consumers, and that its use as a standard credits the gas with greater illuminating value than is obtained in the luminous-flame burners commonly employed. This objection does not seem to us to have any great weight, because argand burners are readily available and not expensive, and they are not used to any considerable extent for the practical reason that the consumer can obtain so much more light from incandescent burners that he uses them in preference. It is safe to say that fully half the gas used for illuminating purposes is burned to yield from four to six times as much light per cubic foot as is obtained from the burner recommended.

In this connection, the Committee say that it must be borne in mind that all the regulations so far made bearing upon illuminating values below 20 candles have been based upon the use of the argand burner for determining the candle power. Therefore if any regulations are to be made invoking the use of a standard burner other than the argand, it will be necessary to reduce the prescribed illuminating value by the amount by which that obtained by the other burner is less than that which would be obtained from the same gas by the use of the argand burner. This difference varies with the illuminating value and the composition of the gas. But for coal gas showing (say) 16-candle power when tested in the argand burner, it will be at least 4 candles, and may amount to as much as 5 candles; and a straight coal gas, manufactured from ordinary gas coals, cannot be expected to have an illuminating value of more than 11 candles when burned in a flat-flame burner. In fact, the latest figures available from London, where flat-flame testing is done in connection with the penalty testing for which the "Metropolitan" No. 2 argand burner is used, show a difference in the case of the gas supplied by the South Metropolitan Company (the only one of the three Metropolitan Companies making straight coal gas) of 5·1 candles between the argand and the flat-flame tests; this difference being apparently that between the averages of the two kinds of tests over a period of three months. It should also be noted that the burner recommended is the only one that is suitable for use over the whole range of the illuminating values and composition that will be met in the State, and that its adoption, therefore, does away with the necessity for having a different burner for each quality of gas.

Question of Standard of Light.

The next point to be taken up in connection with the tests for illuminating value is that of the standard of light against which the gas is to be tested. The standard sperm candle made according to the specifications adopted by the London Gas Referees forms, of course, the primary standard, and is understood when the illuminating value is spoken of as being so many candles. But though these candles, when properly handled, give consistent results, the proper handling requires considerable skill on the part of the operator. On occasions it is very difficult to make the candles burn properly; and a great deal of time is lost in making the tests on this account. It is therefore advisable to authorize the use of secondary standards which can be depended upon to give a practically constant light at all times, and by means of which tests of the illuminating value of the gas can be taken more rapidly and easily than with candles.

We would, therefore, recommend that the use of both the Hefner-Alteneck amyl-acetate lamp and the Harcourt 10-candle pentane lamp be authorized; the probability being that the larger companies will prefer the pentane lamp, and the smaller ones the amyl-acetate lamp, which is simpler and cheaper, but against which there is the objection that the flame is not so steady as that of the pentane lamp, and is much more yellow in colour and much lower in intensity. The illuminating value of the amyl-acetate lamp should be taken as 0·9 candle; this being the average of the various values that have been recently published. In the case of the pentane lamp, each lamp used by an inspector should be standardized at some photometrical laboratory, such as the electrical testing laboratories, and a certificate showing its illuminating value carried with each lamp.

Open-Bar Photometer Recommended.

We would recommend that, wherever possible, an open bar photometer be used, set up in a darkened room which is sufficiently large and well ventilated to prevent the temperature in it from rising more than 2° or 3° Fahr., even though the room be closed, and have both the standard burner and the standard source of light burning in it for half an hour. Where it is not possible for the company to provide such a room, a closed photometer of the Evans type can be used. But these photometers must be designed in such a way as to provide ample ventilation without draughts in the towers in which the lights are placed.

If portable photometers are to be used by the inspectors for testing in towns where the sales are less than 15 million cubic feet per year, special precautions must be taken to insure that the results obtained are accurate. The chief precautions necessary are that the photometer be so shielded that no light from any source except the standard burner and the standard of light can reach the disc; that no rubber tubing be used in connecting up the photometer to the gas supply; and that, if a wet meter be used, it be not filled with fresh water for each test—a supply of water that has already been used being carried with the outfit, and small quantities of fresh water added from time to time to make up for the little that may be spilled and lost when emptying and refilling the meter. Unless these precautions are taken, the portable photometer tests will give results lower than the real value of the gas.

The points at which photometric tests are to be taken should in no case be more than a mile from the gas-works.

Testing for Impurities.

Taking up the question of tests for impurities, it does not seem to be necessary to say anything more about the test recommended for sulphuretted hydrogen than that this is the one which, after much consideration of the subject, has been adopted for London and other English cities in which there are special regulations as to testing, and has been the test applied by the general law in England since 1871—being incorporated in the Gas-Works Clauses Act of that year.

As in the case of deficiency of illuminating value, no penalty is to attach to the presence of more than a trace of sulphuretted hydrogen, unless such an excess of this impurity is shown by three consecutive tests, no two of which are to be made within 24 hours of each other.

The recommendation that there be no restriction upon the amount of sulphur compounds other than sulphuretted hydrogen, is based upon the results of the recent investigation in England. [The Committee refer to the report of the Departmental Committee, and the legislation resulting therefrom.] Since the gas coals in general use in the State of New York are much less sulphurous than those generally used in England, and since carburetted water gas, containing practically no sulphur compounds, and as a consequence a mixture of coal gas and carburetted water gas contains a much smaller proportion of these compounds than does straight coal gas, the gas made and supplied in New York State will be naturally freer from such compounds than is the gas supplied in England; so that if it has been found unnecessary to have any restrictions in England, it should not be necessary in New York.

The recommendation that no restriction be placed upon the amount of ammonia in the gas is based upon the fact that the presence of ammonia, to any amount in which it would be likely to be present in the gas as it is distributed, does no damage to the consumer, though it is detrimental to the gas company through its effect upon meters and meter stopcocks. It is therefore to the interest of gas companies that the ammonia be kept down to a low point; and past experience shows that they can be trusted to do this for their own sake, without any regulations, while it is not advisable to have regulations unless they effect some useful purpose.

With regard to the amount of the penalties to be inflicted for failures to comply with the regulations as to candle power and the presence of sulphuretted hydrogen, the chief point is that they should not be made excessive, as has been done in recent gas legislation in New York. In no other district in the world are the penalties inflicted as severe as those that have been fixed by law for New York City. The example set by the Massachusetts regulations in this respect would seem to us worthy to be followed; and we would recommend that neither the penalty for deficiency in illuminating value, nor for excess of sulphuretted hydrogen, be made more than $100.

At a meeting of the Commission held at Albany on the 2nd inst., an order was made as follows: Except as otherwise prescribed by law, the gas sold or manufactured and sold by any person, corporation, or municipality in the State of New York for lighting purposes, except to lighting companies, shall have an illuminating power, if the same be coal gas, of at least 16-candle power; if mixed coal and water gas, of at least 18-candle power; and if water gas, of at least 20-candle power. The tests for candle power are to be made on a basis of a consumption of 5 cubic feet of gas per hour (corrections being made for temperature and pressure above or below the normal—viz., 60° Fahr. and 30 inches barometer), with a standard bar photometer of approved make, equipped with a new style of "F" argand burner, an old style "D" argand burner, or a No. 7 slit-union Bray burner, as may be best suited to the gas tested. Each 100 cubic feet of gas is not to contain more than 10 grains of ammonia nor more than 20 grains of sulphur compounds; and it is not to exhibit any trace of hydrogen sulphide when tested as prescribed by the Commission. The order is to take effect on the 15th prox.

Presentation to Mr. W. H. Bradley, of New York.

The new Astoria works of the Consolidated Gas Company of New York were recently inspected by the members of the Society of Gas Lighting, as guests of the Company, under the guidance of Mr. W. H. Bradley, the Company's Chief Engineer, by whom, as our readers are aware, the works (which have been described in the "Journal") were constructed. After the inspection, the party returned to New York and dined together at the Astor Hotel. An interesting feature of the after-dinner proceedings was the presentation to Mr. Bradley of a beautiful russia leather book with silver ornaments, containing a set of highly illuminated resolutions passed at a recent meeting of the Directors, according to the Chief Engineer and to Mr. Harrison E. Gawtry, the President of the Company, the highest possible praise for the work which had devolved upon them in the inception and carrying out of the vast undertaking. The resolutions, which were embellished with portraits of the above-named gentlemen, bore the individual signatures of all the Directors. The book was enclosed in a mahogany box; and it was presented to Mr. Bradley by Mr. W. R. Addicks, the Vice-President of the Company. In acknowledging the gift, Mr. Bradley refused to accept all the honours bestowed upon him, and claimed that every one of his co-workers was equally entitled with himself to any credit given for the successful outcome of the enterprise.

Mr. Samuel Hornby, the late Chairman of the Harrogate Gas Company, whose death was recorded in the "Journal" for the 19th of March last, left estate valued at £111,784 gross, with net personalty amounting to £109,313.

THE WORK OF THE FIRST WATER BOARD FOR LONDON.

On Saturday next, the members of the Metropolitan Water Board will go out of office under the provisions of the Act by which the Board was constituted to undertake the supply of water in London. It was only what might have been expected, therefore, that, at the ordinary fortnightly meeting last Friday, the Chairman (Sir Melvill Beachcroft) should review the work of the Board during their four years of office. This he did in an interesting address, some extracts from which appear elsewhere. When the Board came into existence, they were confronted with a gigantic task. They had to enter upon one of the most important arbitrations on record; but though it cost £142 555, exclusive of about £91,000 paid by the Board as the costs of the Water Companies, it resulted in the reduction of the claims by £20,000,000. The arbitration business settled, the Finance Committee, most ably presided over by Lord Welby, proceeded to bring the finances of the Board into working order, with the result that the income for the year ending the 31st of March last was estimated at £2,814,510, which represented an increase of £145,208 on that of the Companies during the last year of their existence. This increase was largely due to the growth of the population. The estimated expenditure was £2,765,017, against £2,669,302 for the Companies in the year 1903-4. The Board's working expenses were higher last year by £135,842 than were those of the Companies. Some of this expenditure was what might be called normal; but £33,256 of it was for rates and taxes, on which item, curiously enough, the late Mr. E. J. Smith anticipated a saving of £15,000 in connection with the Government's purchase scheme of 1880.

Summing up the whole matter, Sir Melvill Beachcroft remarked that while the estimated surplus for the year 1905-6 was £20,807, and the actual surplus only £11,838, the amount estimated for the past financial year was £49,493; and this, he added, was likely to be reduced. He therefore had to acknowledge that no saving had been effected as the result of the Board's work; but he did not think any had been anticipated. On this point, however, there may be some difference of opinion. He considered that the financial advantages of the amalgamation of the Companies under one authority would be found in the consolidation of the management as facilitating both distribution and the provision of future supplies. This is a question for the solution of which the Board will look to their Engineers. But while contemplating improvement in the supply, the Chairman pointed out, in connection with the financial position of the Board, that in course of time provision will have to be made for the sinking fund to redeem the large amount that was paid to the Companies as compensation. If such a fund were established now, on the annuity principle, it would require a yearly payment of about £80,000; and the new Board will, it may be supposed, endeavour to provide a sufficient annual surplus to cover it.

A significant fact in connection with the transfer of the water undertakings to the Board—and Sir Melvill Beachcroft directed attention to it—was that no inconvenience to the public was caused by it, and there was no interruption of the supply. But it must be remembered to the credit of the Companies that the works were thoroughly efficient, and that the distributing systems had been linked up by the intercommunication scheme carried out by them. So that during and after the transfer things went on for some time very much as before. But the Board have made a judicious rearrangement of districts, which has necessitated a redistribution of duties among the engineering staff. The appointment of Mr. W. B. Bryan as the Chief Engineer, with Mr. J. W. Restler as second in command, was the most important of these changes; while the general supervision of the official business was entrusted to Mr. A. B. Pilling as Clerk and Mr. F. E. Harris as Comptroller. The responsibility for the maintenance of works is in the hands of the Works and Stores Committee, who, with the assistance of the engineering staff, are proceeding steadily in the direction of their consolidation; and it is here that the greatest economy in working will be effected. Though, as our readers are aware, additions have lately been made to the storage by the completion of the reservoirs at Walton, and others are in contemplation at Molesey and in the Lea Valley, these will only provide for the immediate future; and Sir Melvill pointed out that the problem which the new Board will have to solve will be "the economical and efficient provision of works to meet the future needs of the Metropolis, and to secure a continuance of the present excellent supply." This it undoubtedly is; for while they were reorganizing the staff, the Board did their best to ensure the strictest supervision over the quality of the water sent out, by appointing Dr. A. C. Houston as Director of Water Examinations. The Water Companies, as is well known, kept a strict watch over the quality of the water they supplied, though they were roundly accused of distributing "dilute sewage." But under the Board this work has been increased tenfold; and Sir Melvill was not exaggerating in the least when he stated that there is no city in the world whose drinking water is subjected to such rigorous analysis as London.

Reviewing the work of the first Water Board for the Metropolis, therefore, the financial results may be regarded by some as disappointing. But before pronouncing an adverse judgment upon their work, all the conditions under which it was performed should be taken into account. As already remarked, the Board have been largely employed during the past four years in the reorganization and concentration of their forces. This has now been accomplished; and the new Board will have the advantage of it. But beyond this the Board had to discharge the duty imposed upon them by the Metropolis Water Act of 1902 of bringing in a Bill for the unification of the rating. The large amount of work involved in the preparation of this scheme was borne by the Appeal and Assessment Committee; and if it should be sanctioned by Parliament, it will be something for which the outgoing Board may take credit. At all events, they will have discharged their duty. On the whole, they must be regarded in the light of pioneers; they have prepared the way for those who will come after them. Difficult as their work has been, we think they will acknowledge that it would have been much harder had the undertakings they acquired been in a less efficient condition than that in which they were left by their former owners.

A Portable Gas-Oven.—The Superintendent of the General Fuel and Appliance Department of the Consolidated Gas Company of New York (Mr. W. J. Clark) is circulating particulars of a portable gas-oven which the Company are prepared to instal. It is a reel oven, and needs a floor space of only 4 ft. by 8 ft. The power required to operate it is either gas or electricity. The heating is done by specially devised and patented gas-burners. The oven will hold and bake 80 loaves of 2 lbs. each in 55 minutes, without moving or shifting a single loaf, every loaf being baked exactly alike; or 96 loaves of 1 lb. each in 35 minutes, giving the same results. The fuel necessary for baking the former number of loaves is 100 cubic feet of gas; and the electric power required costs less than 0·6 c. per hour. The oven is strictly a portable one in every sense of the word. It can be moved out and into a store, and in less than two hours it will be fit for baking, providing gas-pipe and power are ready to be connected.

The Manufacture and Use of Peat.—We have received from Messrs. Charles Griffin and Co., Limited, a work on the above subject, the joint production of the late Mr. P. R. Björling and Mr. F. T. Gissing. It was prepared at the suggestion of the late Sir Clement Le Neve Foster, who placed some valuable notes at the author's disposal. Unfortunately, before the completion of the manuscript Mr. Björling died; and the work has been finished by his collaborator. The aim has been to describe the principal methods and classes of machinery that have been adopted from time to time for utilizing peat. In the chapter on the uses of peat otherwise than as fuel there are a few remarks on its utilization for producing illuminating gas, and it is stated that some kinds will yield 14,000 cubic feet of gas per ton. One great advantage claimed for peat gas is the small quantity of sulphur it contains. The text is accompanied by sixty illustrations, and is followed by a bibliography, a list of recent patents relating to peat, and an index. The price of the book is 6s. net.

Murdoch and the Steam-Turbine.—The fact that the steam-turbine has long been wanted and sought for was strikingly illustrated by an anecdote told at one of the recent meetings at Dudley of the Staffordshire Iron and Steel Institute by the Vice-President, Mr. Buchanan, who is also President of the National Foundrymen's Association. Mr. Buchanan was moving a vote of thanks to Mr. Noel (of the firm of Messrs. Willans and Robinson) for a very interesting and instructive lecture upon steam-turbines, with special reference to the "Parsons" and the "Willans" types. Mr. Buchanan said: "The steam-turbine has been wanted for years past; and it is within my knowledge that Murdoch, who, you will remember, was associated with James Watt, made a small one, and a man I know came across it among a lot of rubbish at Murdoch's house. Murdoch's name was on it, so there could be no doubt as to its genuineness. They took this old model to pieces, cleaned it up, put steam into it, and it rattled away; but when they heard it going, they guessed why Murdoch had dropped it. It was because the noise was so alarming. I believe that the model is now in possession of one of the Tangyes."

Gas Directors as Cabinet Ministers.—So far as we are aware, the Colonial Gas Association is the only gas undertaking having Cabinet Ministers on its Board. The Hon. Thomas Bent, the Premier of Victoria, and the Hon. George Swinburne are members of the Victorian Cabinet. Both gentlemen possess an excellent knowledge of gas affairs in Australia, and both are useful members of the Local Board of the Association in Melbourne. Mr. Bent, who is now on a visit to England, a few days ago attended the meeting of the London Directors of the Association, after which he was invited by the Board to a luncheon at the Cannon Street Hotel. It was presided over by Mr. Samuel Spencer, the Chairman of the Association, who, in a few well-chosen remarks, tendered a hearty welcome to their distinguished colleague on his first visit to this country. Mr. Bent, in his reply, spoke of the pleasure it gave him to meet his colleagues, and assured them that in his judgment the Colony was never in a more prosperous condition than it was now, and that the Company would reap the benefit. He also referred to the founder of the Association—Mr. John Coates—whom he was heartily pleased to meet again. The Directors present on the occasion were: Messrs. Samuel Spencer, Charles Hunt, W. C. Parkinson, A. Godwin-Hammack, and F. R. Smith; together with Mr. John Coates, M.Inst.C.E., of Ottawa, Mr. M. W. Swinburne, of Newcastle-on-Tyne, and Mr. Alfred J. Kingdon, the Secretary of the Association.

LIGHT AND ILLUMINATION.

The "Transactions of the Illuminating Engineering Society" for January contained a paper on this subject by Dr. C. P. Steinmetz, in which the author dealt with many theoretical considerations affecting the primary production of light and its physiological effect upon the human eye in the way of illumination. The paper is unnecessarily a lengthy one, due to some repetition and lack of conciseness. The latter defect, together with looseness in the use of terms, somewhat impairs the value of the contribution, which, dealing as it does with fundamental principles, should contain much that is stimulative and important in the practice of illumination.

Radiant Energy.

The first part of the paper is devoted to the general question of radiant energy; light being described as the physiological effect exerted upon the human eye by radiations within a certain narrow range of frequency. Radiant energy is derivable from various forms of energy, and among others from heat. In the case of the incandescent lamp filament, the heat energy is converted, and issues as a group of radiations of different wave lengths—*i.e.*, different frequencies. The radiations from heated bodies are comparatively all of extremely high frequency—that is, many millions of cycles per second. At the same time, they cover a very wide range—many octaves—of frequencies; and from this group of radiations, of all frequencies, somewhat less than one octave can be perceived as light. Lower and higher frequencies than this octave are invisible; the former being known as radiant heat, and the latter as chemical rays, though these terms are misleading, since there is no distinction in character between radiations of different frequency—all being convertible into heat. Rays of a lower frequency than the visible ones will be felt as heat, because they contain a larger amount of energy. The visible rays represent very little energy, and therefore do not give as much heat. It happens that most of the available means of producing radiant energy give high intensities of radiation for low frequencies only, the invisible infra-red rays—it not being yet possible to produce anywhere near the same intensity of radiation at higher frequencies.

The total energy of radiation from the heated body may be measured very accurately. It is possible to go further, and split up the total radiation into its various wave-lengths of different frequencies, and then collect all the radiation within the visible range and measure its energy. In this way, the energy of the visible radiations may be measured and compared with the total energy radiated. While this would give the physical measure of the efficiency of the process of producing visible radiation, it would not be the efficiency of producing light, since unfortunately the different wave-lengths of the visible radiation have very varying physiological effects. An amount of energy giving the effect of green light represents an entirely different amount of light, and causes a much greater physiological effect, than the same amount of energy in rays of the wave-lengths which give the impression of red light. It follows from this that the physiological effect or light equivalent of mechanical energy within the visible range is the function of the wave-length, and varies with the colour. This is obvious, because the energy radiated at low frequencies represents no light whatever, and has no physiological equivalent; it is invisible. Coming to the visible range, there is a physiological effect—viz., light. In passing from the invisible into this visible range, the physiological equivalent must continuously pass from zero into a finite value. The maximum is reached in the middle of the visible range, in the green and yellow; then it decreases down to zero at the violet end of the visible rays. In other words, the efficiency of light production is the function of the wave-length—that is, of the colour—and is at its maximum in the middle of the spectrum, where the same amount of power, measured in watts, gives the largest amount of light measured in candle power.

Unfortunately, the physiological equivalent of power, or the physiological effect of light, varies not only with the wave-length, but also with the absolute intensity. In the comparison of lights of different colours, great difficulties are met, since there is no physical measure of light. They cannot be compared directly; and with widely different colours, not even an approximate comparison can be made. The use of light in actual illumination gives a fair method of comparison as, for instance, in the measurement of the distance at which a certain size of print can be read by red and green lights, subsequently calculating for the intensity. The comparison, however, has not the accuracy of a photometrical test, since only physiological effects on the eye are compared, and different observers may have different personal constants. But individual differences are not great; and measurement of the intensity in candle power of different coloured lights is feasible by some such method. It is found, however, with green and red lights which at a certain distance are apparently equal in intensity, that at a shorter distance the red appears more brilliant, and that at a greater distance the green seems the brightest—the latter still showing when the red light becomes almost invisible.

That is, the relative physiological effect of different wave lengths varies, not only with the wave lengths, but also with the absolute intensity of illumination, and while throughout the whole range the sensitivity of the eye for green light is much greater than for red light, the difference is far greater for low than for high illuminations. That is, the ratio of sensitivity for green compared with that for red is greater for faint illuminations than for intense illuminations. If it be desired to express lights of different colours in candle power, it seems necessary also to give the distance, or the intensity of illumination at which the observations were made. In other words, the light from the middle and the short wave end of the spectrum gives a better and more efficient illumination when the total intensity of illumination is low than the long or low frequency rays of red, orange, and yellow, but the latter colours give a much more brilliant effect at high intensities than the same amount of light of shorter wave-length.

This is of importance for the illuminating engineer, because when it is desired to get high intensity effects, as in decorative lighting or in advertizing, better results are given by the low frequency end of the spectrum, by orange and yellow light, whereas when a low intensity of illumination is satisfactory, as in street lighting, better results are given by the short wave end or the middle of the spectrum, by the greenish-yellow of the Welsbach gas-lamp and the bluish green of the mercury lamp.

Primary Means of Producing Light.

In the second part of his paper, Dr. Steinmetz considers some of the present primary means producing light. Until the development of the Welsbach mantle, all methods were based on incandescence, resulting either from the chemical energy of combustion or the electric energy of the incandescent or carbon arc lamp; the temperature being raised to such a high value that, among the total radiation issuing from the heated body, a certain very small percentage appears within the fraction of the octave of visible light. The higher the temperature reached by an incandescent body, the higher is the average frequency of radiation; and so a larger percentage of the total energy of radiation is within the visible range, and is light. Thus the problem of light-production is the problem of reaching as high a temperature as possible in the luminous body. In the gas-flame, this temperature is that of combustion, and is rather limited. In the incandescent lamp, it is limited also by the self-destruction of the incandescent body. The difficulty is to find materials which can stand very high temperatures. The temperature of the gas-flame may be increased by increasing the rapidity of combustion. A still higher temperature may be obtained by the admixture of air; but in this case the incandescent body—the carbon or the heavy hydrocarbon particle—is destroyed; and it is then necessary to insert a luminous body of some other material, though in no case can very high efficiencies by incandescence be reached, because of the temperature limit.

However, the efficiency of light production might be increased if an incandescent body be found which does not radiate in the same manner as the carbon filament or the so-called carbon particle, but which gives an abnormally low radiation in the low frequency range, or an abnormally high radiation in the high frequency or visible range. Such a body may be said to give selective radiation, because the distribution of energy amongst the different frequencies of radiation in the spectrum is not the same as it would be with an ordinary black body at the same temperature. If a body be found which gives an abnormally low radiation in the visible range, or abnormally high radiation in the invisible range, this body would be an abnormally inefficient light producer. Inversely, if a body give abnormally high radiation of short wave lengths in the visible range, or abnormally low radiation of long waves of low frequency, this would be an abnormally efficient incandescent body. Such bodies exist, and the enormous progress in gas lighting made by the introduction of the Welsbach mantle is based on such selective radiation; that is, the oxides do not radiate the same range and intensity of waves as a black body, the incandescent carbon, but give an abnormally large amount of visible rays compared with invisible rays; that is to say, they give a larger percentage of high frequency light rays compared with the low frequency invisible rays. Possibly, and even probably, some of the highly efficient metal filaments, like the Tungsten filament, also owe their high efficiency of one watt per candle power to selective radiation.

In an incandescent lamp filament a definite pitch, or definite frequency of vibration, is not given, but there is an infinite number of different waves. The reason is, perhaps, that in a solid or liquid body the vibrating particles are so close together as to interfere with each other. If a body could be set in vibration, in which the vibrating particles, atoms or molecules, are so far apart as not to interfere with each other, as, for instance, in a gas at low pressure, then they would execute their own periods of vibration, and the light from such a body would not be a radiation of all wave lengths, but a radiation of only a few definite wave lengths, or a line spectrum. Thus incandescent or luminous sodium vapour gives only one kind of light, a yellow spectrum line, and in addition thereto a number of infra-red and ultra-violet rays.

When a gas or vapour is set into vibration, it vibrates at its own frequency, independent of the temperature, and it is merely a question of the character of the material whether a very large percentage of the total energy of radiation happens to be within the visible range or outside the visible range. Temperature does not come in as a factor, because the frequency of radiation is no longer a function of the temperature, but is independent of it; sodium vapour gives the same frequency of radiation, the same yellow line when the sodium vapour is at low temperature or at high temperature. Some spectrum lines may increase in intensity with an increase of temperature faster than others, and the colour of light may change with the temperature, may change from yellow to white or blue, or from green toward white or red, as the mercury light does with

increasing temperature, but that is merely a characteristic feature of that particular body, and not a general temperature effect. The possibility therefore exists of finding materials which, when energized as vapour or gas, give a spectrum with a large amount of energy in the visible range, thus giving an efficiency of light production far in excess of that available by incandescence.

So far the only materials which give these characteristics are mercury, calcium, and titanium. These three metals give spectra which contain such a large percentage of the total radiation in the visible range that the amount of light measured physiologically in candle power is far in excess of that which possibly could be produced by incandescence, even with the assistance of selective radiation.

The Practical Side of the Subject.

The author then proceeds to deal with the practical side of the subject; pointing out the importance of not only considering the amount of light issuing from the flame, but the amount of light which reaches objects to be illuminated. The demands of illumination are mainly of two classes—general illumination, and local or concentrated illumination; and there are cases where a combined general and local illumination is more efficient and satisfactory. Either direct or indirect light may be used, though, as the author suggests, the latter method may at times unavoidably involve considerable waste of light. Indirect illumination can be carried out by reflection or refraction with reflectors or frosted globes, or by reflection from the ceilings and walls. It is obvious that white walls give the highest efficiency; but it is not always feasible to have such surroundings. Walls may be dark or discoloured by age. Discoloration by age is due to either iron or carbon, which respectively give red-brown or brown-yellow tints. This age-colour is in the long wave or low frequency end of the spectrum.

To get the benefit of reflected light from walls which cannot be kept perfectly white, a source of light rich in the long low-frequency waves or of a yellowish tinge is, therefore, more efficient, as it gives more reflection from the walls than a source of light rich in short or high-frequency waves, such as bluish-white.

The shade of colour of the illuminant may be very essential in getting efficient illumination. In the interior of a city, the walls usually have a reddish-yellow colour. In that case white or yellowish lights are superior. Outside of the city the greenish-yellow light of the Welsbach lamp and the bluish-green of the mercury arc give much larger amounts of reflected light from vegetation than do the yellow of the incandescent lamp, and a better illumination results. Vegetation absorbs the long waves, the low frequency radiation, so that with a yellow source of light there is practically no reflection from living vegetation. On the other hand, there is reflection of the long waves from dead vegetation; and in the light of the incandescent lamp or the flame arc all vegetation appears very poorly, because the dead parts are brought out prominently. The reverse is the case where the light is deficient in the red and yellow, and rich in the green and blue; the green shows prominently, but the dead leaves are not visible.

Eye Adjustment to Suit Amount of Light.

Dr. Steinmetz, in the succeeding part of his paper, further reminds his hearers that it is not the amount of light which reaches the illuminated object—that is to say, the physical intensity of illumination—which is of importance, but the amount of light from the illuminated object which reaches the eye. He alludes to the power the eye possesses of adjustment to suit the intensity of light, and notes the possibility of a high physiological efficiency being attained in the case of lights of low intrinsic brilliancy by reason of the widened opening of the pupil with non-fatigue of the eye. In efficient illumination, it is of the greatest importance to arrange the illuminant so as not to have excessive intrinsic brilliancy in the field of vision.

It appears that the automatic protective faculty of the eye was developed through the ages as a protection, not against light, but against energy; apparently the eye is protecting itself against the energy of the radiation, and not against the physiological effect, and since the energy of radiation is mainly in the ultra-red, in the long waves, the frequencies which cause the protective reaction are those of the long wave end of the spectrum, the red and yellow; they make the pupil contract. This action is much less for the green and blue rays, which is the reason the eye does not react to the mercury lamp to any great extent. Therefore a green light, such as is given by the mercury or Welsbach lamp, may be placed more freely in the field of vision, without causing the contraction of the pupil and thus reducing the physiological effect. This is of importance in places where the light can not well be taken out of the field of vision, such as in street illumination. Here all the sources of light must be arranged along the street and so must be in the field of vision. By cutting off the red end of the spectrum the contraction of the pupil may be eliminated, and the full benefit of the illumination between the lamps be obtained. It is otherwise with a yellow source of light, such as the incandescent glow or arc lamp. The physiological effect of the lighting by a green illuminant is, in such cases, superior to that by a yellow illuminant; the illumination appears brighter and more uniform.

A light devoid of red and yellow rays is at the same time the safest and the most harmful. It is the safest and gives the most uniform illumination if its intrinsic brilliancy is sufficiently low to be below the danger limit of energy of radiation, but is harmful if above that, because the eye does not protect itself against it, probably because these lights have not existed throughout all the ages during which this protective action was being developed, when sunlight and fire were the only sources of light, both of which are rich in red rays. This accounts for the rather contradictory effect observed, that green or blue light, such as given by the Welsbach mantle or the mercury lamp, is a very good light to work by, superior even to the yellow kerosene lamp; and at the same time there is suspicion that it may be harmful to the eye. It may well be that when it is of very high intensity, the automatic action of the eye is not sufficient to protect it against such light. Where such sources of light are used, the benefit of the absence of the contraction of the pupil may be obtained, but the illumination must be arranged so as not to get the harmful effects against which the automatic protection of the eye fails. All of these blue and green lamps are superior for illumination if they have intrinsic brilliancies, but are somewhat questionable if they have extremely high intensities.

Differences of Colour and Intensity.

The author points out another important factor in illumination—that of the recognition of difference in colour and in intensity, inasmuch as seeing is affected by both. If in the illuminated area the light is of uniform intensity, and everything of the same colour, nothing but a glare of light will be seen. Difference in intensity includes shadows; and these are essential to the perception of objects. In the consideration of differences of colour and intensity, illumination may be divided into directed and diffused illumination. In the first case, shadows exist; but in the second, the general lighting is approximately uniform.

Where definite colour distinctions are required, the sharpness of vision may be intensified by selecting that colour of light best suited to bringing out the colours desired. Where the colour conditions to be distinguished are those of age, due to iron and carbon, then that light which is deficient in red and yellow, and which therefore shows the colours given by iron and carbon as black, gives a much sharper distinction. The light of the mercury lamp makes blemishes and dirt much more pronounced than a white light. Again, the sources of light which are rich in red and yellow rays emphasize the colours due to iron and carbon less, and make less noticeable blemishes of a slight amount of dirt. Where the colour distinctions are those due to these two most prominent elements, their appearance will be greatly softened in the yellow light. Under the green light they will be made harsh and sharp. If it is desired to soften effects, as in a ballroom, use the green Welsbach light, or the bluish-green mercury arc, which gives sharp distinction where white light shows little and yellow light nothing. Where it is desired to see all colours in about the same relation as by daylight, obviously a white light is necessary.

General and Diffused Illumination.

Dr. Steinmetz states that it is necessary to distinguish between general and local illumination, between direct and indirect illumination, and between directed and diffused illumination. These classes to a certain extent overlap, but are nevertheless distinct; mistakes being easily made by neglect of this fact. As an instance, the author points out the difference between general and diffused illumination. The first may be obtained by using one source of light with a reflector giving uniform distribution. The second would be attained by the employment of small units of light around the cornices, with reflection from white walls and ceilings. The intensity of light may be the same throughout the room; but in the one case there would be black shadows, and in the other none. In the general lighting of a drawing-office, diffused lighting is required—here one sees by differences in colour and in intensity, and not by shadows, which would be objectionable to work by. For domestic purposes, the absence of shadows would probably make diffused illumination unsatisfactory and trying to the eyes, because objects would not be sufficiently distinct. Where a high intensity is obtained by reflection from white walls and ceilings, the effect may not be agreeable as in the case of darker walls, since there would be too large a percentage of diffused lighting; the intensity being great as compared with a directed light. The problem is to get sufficiently directed and sufficiently low diffused light to give the best vision.

During the daytime there is directed light from the windows and diffused light reflected from the walls. To get the proper proportion between directed and diffused light is what fixes the shade of the walls, and in general it is necessary to have the walls of somewhat darker colour. But when lighting in the evening with a source of light like the incandescent lamp or the gas-lamp, which sends out light in all directions, the diffused light as compared with the concentrated or directed light is greater than in the daytime for the coloured walls, due partly to the colour of the light, which is yellow and reflected more, but largely because the directed light coming through the window forms a much larger percentage of the total light than that of the lamp, where only a small part is concentrated light. It is not comfortable to have this strong diffused light, and therefore the walls are shaded so as to absorb three-quarters of the light. That means waste, however, and the light which is not used must be paid for. Proper illuminating engineering, then, is to secure the correct distribution of light so as to give the desired amount of concentrated lighting on the dining or reading table, and to give only as much diffused lighting as is compatible with the amount of direct light used. The problem of domestic lighting, from the illuminating engineering point, is to determine the proper illumination over the entire area, and also the character of illumination, whether directed or diffused, and how much of the light should be concentrated, and how much should be directed. Another important feature is the question of colours and shades already discussed. Problems are solved by trial, which usually means producing more light than is necessary, and throwing away the excess of the diffused light by absorption.

GAS MANUFACTURING FROM PEAT.

By PHILIP I. COHEN, of New York.

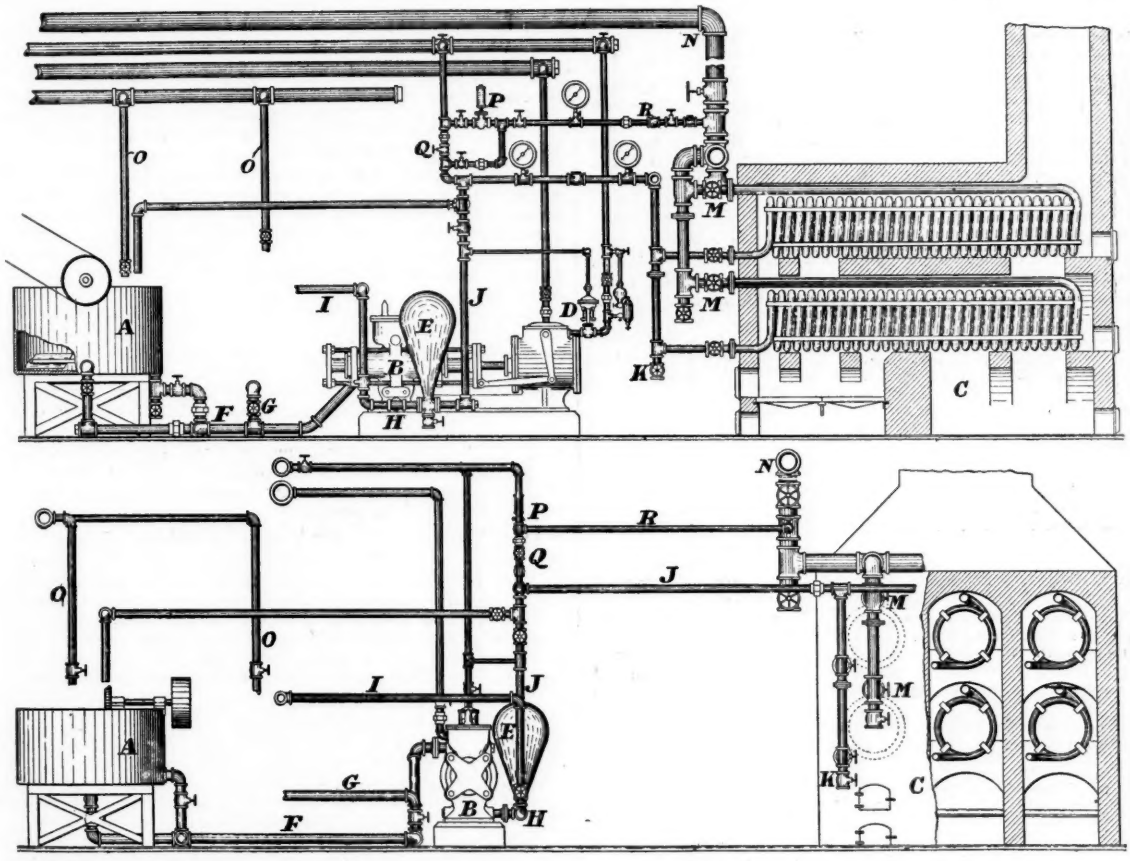
In answer to your inquiry, it will give me pleasure to explain as fully as possible the method and working of the apparatus of the Fuel and Gas Manufacturing Company, and to make clear the claim that the process manufactures better gas at less cost than any other. I have nothing to say as to the advantage of gas over solid fuel for producing heat and power. That I leave to you, as being better able to enlarge upon the subject than am I.

The apparatus of the Fuel and Gas Manufacturing Company produces very high candle-power gas (55 to 60) from an emulsion of peat, fuel oil of the lowest grade, and water. The principle of construction of this apparatus is different from that of others; and the highest candle-power gas can be made with but one fixing, while without changing the emulsion the candle power can be reduced to any desired quality. The yield of each coil is increased according to the quantity of steam injected, with, of course, a corresponding decrease in candle power. One of the advantages of this method is that no mechanical devices are necessary for purifying and scrubbing the gas. With the slightest lowering of the temperature, which starts to take place as soon as the gas leaves the coils, the impurities begin to precipitate and pass off with the condensation as bye-products.

Unlike other gas-generators, this gas is made at a pressure of 25 to 60 lbs. to the square inch; and consequently the plant requires no exhaust pump or any of the devices ordinarily used in other processes for putting gas in the holder. The emulsion enters the coils at the pressure at which the pump is set to work; and when it leaves the coils at the outlet, the gas is perfectly made and fixed. The pressure is kept automatically uniform. The passing off of the impurities with the condensation obviates the necessity for separating the impurities from the gas by mechanical devices. There is thus no further expense between the generator and the holder; and besides this, valuable space is economized. Both these items are large considerations with all gas makers.

The accompanying illustration shows a battery of six coils. As each of these coils has a capacity of 1000 cubic feet per hour of 60-candle gas, it will be noted that the capacity of the six coils is 144,000 cubic feet per day of 24 hours. Each of the coils contains 300 feet of 1 inch and 1¼ inch extra heavy wrought-iron pipe—the latter size to allow for expansion of the gas. The outside diameter of the coils is 24 inches. These coils correspond with the clay retorts in coal-gas works; but it is readily perceived that a battery of six coils will take up less space than a bench of the same number of clay retorts, and the yield will be at least three-fold. The coils can be made of any shape for economizing space in the furnace, so long as each one contains the requisite number of feet, and the bends are not too sudden. The pipes are kept red hot all the time; and any kind of fuel can be used for the purpose. We have employed the gas for heating the furnace direct from the coils while it was red hot; but our experience is that it is more economical to take it from the holder after the whole of the bye-products have been precipitated by condensation. Any number of coils can be placed in a battery. An emulsion is used for making the gas.

In the illustration, A is a tank for holding the emulsion, with an agitator to keep it well mixed. B is a pump for forcing the emulsion through the coils. D is a regulating valve governing the steam-cylinder of the pump. This maintains an even and constant pressure upon the emulsion in the coils, which gives a uniform flow and quality of gas. The gas can be made at any pressure. The higher the pressure, the faster the gas is produced; but it is necessary to use proportionately greater heat in the furnace. A pressure of 25 lbs. to the square inch has been used in making gas for all our analyses. The emulsion is forced through the pipe J to the intake of the coils above the valve K; and when it comes out of the outlet of the coil at M, it is fixed gas of 60-candle power, and requires no more "cooking." All the outlet-pipes outside the furnace are red hot for some distance from the coils; and it is here (at R) that the live steam is introduced into the red-hot gas for reducing the candle power. This gas, while it is red hot, will absorb more steam, turning same into gas, than will the incandescent coal in the water-gas processes. The carbons are red hot, and in their nascent state will mix more readily with steam for the making of permanent gas than with coal heated up for this purpose, which cools every few seconds. The pump B is made specially for the work, and can be built to take care of any number of coils. The regulating



A.—Mixer tank with agitator.
B.—Pump.
C.—Furnace showing coils.
D.—Regulating valve governing steam-cylinder of pump so as to maintain a constant pressure on emulsion or oil.
E.—Chamber on emulsion line of pipe.
F.—Line of pipe from mixer to pump.
G.—Pipe line from wash-barrel to pump.
H.—Emulsion discharge-pipe from pump.
I.—Branch of emulsion discharge-pipe to wash-barrel.
J.—Emulsion pipe going to coils in furnace.
K.—Blow-off valve on emulsion line of pipe at entrance to coil.
M.—Outlet pipe from coil (or gas end of coil).
N.—Pipe to gasometer (or holder).
O.—Pipe from water-main with hose attachment for washing purposes.
P.—Regulating valve controlling steam pressure from steam line running into emulsion line.
Q.—Bye-pass for regulating valve.
R.—Branch of live steam-pipe from P, for conveying live steam to the outlet of the coils. This for reducing the candle power of the gas.

The Plant of the Fuel and Gas Manufacturing Company of New York.

valve P is for reducing the live steam to pump pressure, for mixing with the gas as needed.

It will be seen how automatic the apparatus is, and how few men are required to work it—the pump taking the place of men. Any kind of cooler or condenser will serve to change the temperature of the gas—this does not come under the patents. The gas being made under automatically controlled pressure, renders the quality and flow uniform; and there is no undue pressure or injury to the coils and pipes. This uniformity and constant pressure prevent deposits of tar and lampblack or hard carbon from building up on the interior walls of the coils. There is absolutely no possibility of stoppage of pipes. The gas can be delivered to any number of holders, situated at any distance from where it is generated, without the use of pumps.

In many parts of Europe, owing to the scarcity of coal, bog has been dried and used as fuel, irrespective of its cost. In the United Kingdom, as also in our United States where peat is found in unlimited quantities, the cost of its preparation has prevented it from becoming a commercial commodity; and while within the last thirty years there have been many processes for the utilization of peat as fuel, all have been failures commercially, on account of the expensive machinery for drying and briquetting. Some scientists claim that with the rapid development of the modern gas-engine, peat will outrival the mountain stream as a source of power, and that thus will be realized the dream of those who live in the vicinity of peat bogs. We find by practical experience that in drying and compressing the peat, the volatile gases which go to make up the best heat elements in peat are lost. By our methods alone can peat be used commercially, as all the various gases are saved and stored in gasholders for future use. The volatiles from peat show from 9 to 10 candle power gas.

The formula we are using for the emulsion of peat, oil, and water for all data is: Peat (paste) 30 per cent., fuel oil (lowest grade) 25 per cent., water 45 per cent. Of this emulsion, 326 lbs. will yield 1000 cubic feet of 60-candle gas, and a liquid bye-product weighing 146 lbs. There is thus contained in 326 lbs. of emulsion—

30 per cent. peat weighing	97·8 lbs.
25 per cent. fuel oil ,,	81·5 ,,
45 per cent. water ,,	146·7 ,,
Specific gravity 96·33	326 lbs.

We use the words "peat paste;" and in further explanation of this, it may be stated that the peat, when taken from the bog, has to be ground, not only because it is full of fibre which would soon choke the pumps, but more particularly to break up the molecular construction of the peat-cells. In order to accomplish this grinding without burning the peat or destroying the mill by heat generated by abrasive force, it is necessary to add ½ lb. of water to 1 lb. of peat. It comes out of the mill of the same consistency as chocolate paste; and this is the 30 per cent. put in the emulsion; so the emulsion formula is really: Peat 20 per cent., oil 25 per cent., and water 55 per cent. Peat as taken from the bog contains a large amount of water; so that this formula might still be reduced. In view of this, and to corroborate our statements for data, our Chemist analyzed the ground peat (paste); and the following was the result:—

	Per Cent.
Dry peat	14·2
Moisture	85·8
	100·0

Thus the further revised or final formula would be:—

	Per Cent.
Dry peat	4·26
Oil	25.00
Water	70·74
	100·00

The dry peat analyzed as follows:—

	Per Cent.
Volatile matter (red heat)	60·0
Fixed carbons	32·0
Ash	8·0
	100·0

We then had the emulsion analyzed for the purpose of confirming the above; and the following was the result:—

	Per Cent.
Specific gravity, 96·33.	
Volatile matter at 212° Fahr.	6·80
,, ,, ,, 228° ,,	76·00
,, ,, ,, 350° ,,	13·00
Fixed carbons at red heat	3·80
Ash	0·38
	99·98

The following is the analysis of fuel oil used:—

	Per Cent.
Carbon	87·01
Hydrogen	12·41
Sulphur	0·20
	99·62

The following is an analysis of the gas from the above emulsion made by the Fuel and Gas Manufacturing Company, showing the combustibles and incombustibles per 1000 cubic feet:—

	Per Cent.	Lbs.	B.Th.U.
Carbon monoxide (CO)	6·0	4·4400	19,469
Hydrogen (H)	22·0	1·1660	72,292
Marsh gas (CH_4)	33·5	14·3715	344,571
Ethylene (C_2H_4)	31·1	23·0140	494,148
Total combustibles	92·6	42·9915	930,480
	Per Cent.	Lbs.	
Carbon dioxide (CO_2)	3·1	3·6022	
Oxygen (O)	0·6	0·5050	
Nitrogen (N)	3·7	2·7380	
Total incombustibles	7·4	6·8452	

The candle power of this gas by the photometer table was 60.

We submit for comparison the following analyses of the two kinds of gas furnished to the City of New York. The gas was taken from the city mains after it had been purified and scrubbed, and all impurities eliminated. The water gas contained the following combustibles and incombustibles per 1000 cubic feet:—

	Per Cent.	Lbs.	B.Th.U.
Carbon monoxide (CO)	30·7	22·7180	99,618
Hydrogen (H)	32·4	1·7172	106,466
Marsh gas (CH_4)	13·9	6·9631	166,947
Ethylene (C_2H_4)	12·8	9·0000	198,000
Ethane (C_2H_6)	3·0	1·6600	36,520
Total combustibles	92·8	42·0583	607,551
	Per Cent.	Lbs.	
Carbon dioxide (CO_2)	2·7	3·1374	
Oxygen (O)	0·7	0·5894	
Nitrogen (N)	3·8	2·8120	
Total incombustibles	7·2	6·5388	

Candle power, 20.

The coal gas contained the following combustible and incombustible gases per 1000 cubic feet:—

	Per Cent.	Lbs.	B.Th.U.
Carbon monoxide (CO)	8·0	5 904	25,889
Hydrogen (H)	47·0	2·470	153,140
Marsh gas (CH_4)	36·0	15 157	363,404
Ethylene (C_2H_4)	4·3	3·173	68,143
Ethane (C_2H_6)	0·5	0·200	4,400
Total combustibles	95·8	26·904	614,976
	Per Cent.	Lbs.	
Carbon dioxide (CO_2)	1·6	1·8592	
Oxygen (O)	0·4	0·3368	
Nitrogen (N)	2·2	1·6280	
Total incombustibles	4·2	3·8240	

Candle power, 20.

We also submit an analysis of producer (fuel) gas, copied from a report of an authoritative standard maker, whose statement included the fact that the gas for the analysis was made for this special test.

Producer (fuel) gas contained the following combustibles and incombustibles per 1000 cubic feet:—

	Per Cent.	Lbs.	B.Th.U.
Carbon monoxide (CO)	25·0	18·5000	81,122
Hydrogen (H)	19·4	1·0282	63,748
Marsh gas (CH_4)	5·3	2·2737	54,514
Ethylene (C_2H_4)	4·3	3·1820	68,336
Total combustibles	54·0	24·9839	267,720
	Per Cent.	Lbs.	
Carbon dioxide (CO_2)	4·0	4·648	
Oxygen (O)	0·6	505	
Nitrogen (N)	41·4	30·636	
Total incombustibles	46 0	35·789	

A qualitative examination of our bye-product—which is a gray or drab-coloured watery mixture, as shown by chloric acid test—indicates that it contains a large quantity of oxidizable substances, among which are ammonia acetate, ammonia derivatives or compounds containing carbons, in addition to nitrogen, hydrogen, and hydrocarbons mechanically mixed with water, also a trace of pyroxylic spirit, and probably some phenol or so-called carbolic acid. All of these are saleable to manufacturers of chemicals and aniline colours; and these we have in the place of unsaleable ashes and clinkers that result from other processes. Special attention is invited to this as one of the system's great savings in labour, as the men do not have to fill coils or take out ashes. One man could attend to fifty coils if necessary, and still have time to take care of his pumps, &c. In fact, the plant is so automatic that even in large gas-houses three men could run it.

An advantage over processes now in use is that we accomplish more economically the enriching of water and coal gas for illuminating purposes. In the ordinary enriching of water gas with oil or petroleum, much tar and hard carbon are produced, causing serious loss in the use of oil. In this method of using the oil, we manage to chemically split the tar in such a way that the carbon of the tar remains in combination with enough hydrogen to retain the form of permanent gas. Therefore, when mixed with other gases, no condensation or tarry products are formed, and no petroleum is lost in producing tar and coke.

The exclusion of air is another one of the advantages in the manufacture of this gas. No air gets into the gas from the time

the operation begins until it reaches the holder. This shutting out of the air has much to do with the production of the large percentage of ethylene, which is the most valuable compound for both heat and light in any gas. This ingredient is not poisonous, as is the deadly carbon monoxide; and besides this, there is no danger of any explosions while in process of manufacture. Of all gases in the mixtures supplied by different processes for general illumination, the most important after acetylene is ethylene. At present, on account of its high cost, very few (if any) gas companies furnish any acetylene in the gases which are circulated through street mains in cities and villages; and therefore ethylene is practically the only illuminant depended upon by the gas companies to give illuminating power to their output.

Besides ethylene being a measure of illuminating quality, the percentage of it in gas is also the measure of the value of the gas mixture for fuel and heating purposes. It is commonly understood that, weight for weight, hydrogen gives more heat by its combustion than any other ingredient in ordinary gas; but as hydrogen is extremely light in weight, and all kinds of both light and fuel gas are measured and sold by volume and not by weight, and as ethylene is very much heavier than either methane or hydrogen, it becomes a fact that the calorific value as well as the illuminating quality of any mixture of gases as now sold to consumers is actually gauged by the percentage of ethylene. In other words, the more ethylene the better the gas for every purpose, except that of aerial navigation.

The large percentage of illuminants found in the gas made by this Company's apparatus and methods gives more heat units than the non-illuminants hydrogen, carbon monoxide, and marsh gas, such as are found in gases of other processes; and it is contended that these extra heat units are due to the large percentage of the heavy ethylene of which the gas is composed. In cases where gas is used by volume and not by weight, the heavy gases will count for heat units as well as for light. On referring to the tables, it will be seen that the illuminant (C_2H_4) forms the largest percentage by weight of any one ingredient in our gas—23·014 lbs. per 1000 cubic feet, which means 494,148 B.Th.U. for this one ingredient per 1000 cubic feet of the gas. Further comment on this point is unnecessary.

For the purpose of comparison, it may be stated that the producer (fuel) gas companies claim that "a large proportion of the energy of fuel gas lies in its sensible heat, which is all lost if the gas is allowed to become cold before using." But the experience of this Company shows totally different results, and confirms what was known by experienced engineers—that no more heat units are gained out of gas hot than out of gas cold. With gases containing a large proportion of incombustibles, the conditions are different. A cubic foot of fuel gas at a temperature of 60° Fahr., when heated to 310° Fahr. measures 2 cubic feet; but it contains no more combustible matter than before. In other words, there are as many units of heat per unit volume in a cubic foot of cold gas as in the same quantity of hot gas. The expansion neutralizes the extra heat units; and it is at once apparent that the impurities in the gas, even when hot, retard perfect combustion, thus wasting the heat in the good gases.

The heat units of producer (fuel) gas, as compared with this Company's gas, are only 1·347 parts per unit volume. In other words, 1000 cubic feet of fuel gas give only 267,720 B.Th.U., as against 930,480 B.Th.U. in 1000 cubic feet of gas made by this Company. Eliminating the incombustible gases, the general run of fuel-gas processes have only 48 per cent. of combustibles with which to make heat units.

The apparatus of this Company will make gas from oil with greater economy than any yet invented. Most of the tar in the oil is utilized by turning it into gas during the process of making; whereas other plants are troubled with tar-clogging. It is well known that oil and water will not mix; but we have found that oil and steam under pressure will mix. Consequently, some live steam is introduced into the oil at the intake of the coils, and then again at the outlet of the coils, while the gas is red hot; and the desired result is accomplished.

Samples of our gas were kept in a glass for eight months; and on examination it was found to be in as good condition as when made, both as to candle power and composition, with not a trace of discoloration of the glass containing it. Furthermore, no mechanical or other means had been used to purify it. It is well known that gases made by gas-house practice, even though purified, will not make such a showing.

It is maintained by the authorities that, in direct firing with solid fuels, combustion is always imperfect—often 50 per cent. of the energy of the coal passing up the chimney. Now, the advantage of indirect firing (converting the fuel into gas) is the preventing of the escape of unburnt carbon oxide up the chimney, and applying the heat exactly where it is wanted. Carbon monoxide, when mixed with carbon dioxide (and this mixture is always produced in direct firing with coal), prevents the monoxide from burning. In proof of this may be cited the almost universal use of the Babcock and other chemical fire extinguishers. The compound used in these engines is carbon dioxide.

While the general run of fuel-gas producers do not generate a gas that has perfect combustion, it is an error to suppose that the gases are not fixed. This our experts make clear. We claim that all these producers do make fixed gas; but the trouble with them is that they generate, by their construction and methods, an unnecessarily large percentage of the worse than useless carbon dioxide and nitrogen. On referring to the tabes, it will be perceived that gas made by this Company's process contains only 7·4 per cent. of incombustible impurities, as against fuel gas containing 52 per cent. It will also be noticed that our gas containing 7·4 per cent. of incombustible impurities has not been purified by mechanical devices; while water gas, with its 7·2 per cent., and coal gas containing 4·2 per cent., have been purified. Incombustible gases like carbon dioxide and nitrogen contribute absolutely nothing to the heat of the combustion of the combustible gases with which carbon dioxide and nitrogen may be mixed. On the contrary, they absorb heat, and prevent perfect combustion of the true fuel. The carbon dioxide being cold and heavier than the combustibles [see tables], will hang in the combustion chambers, not allowing the combustible gases to burn, but mixing with them, and carrying them out of the chimney without igniting.

Fuel gas is seldom, if ever, purified; and consequently, as coal contains more or less sulphur, this gas holds quite a percentage of impurity. When sulphur is distilled from coal without being burnt, the sulphur condenses to a solid mass as soon as the temperature falls to 300° Fahr. When coal is burned, the sulphur is reduced to a fixed gas, sulphur dioxide—a pungent acid gas, which, unless there can be an excess of hydrocarbon gases like ethylene and methane present when it comes in contact with melted iron or steel, is quickly reduced and produces iron oxide and iron sulphide. These injure every good quality in both iron and steel; and all iron workers fight shy of them. It is therefore very clear that fuel gas is ill-adapted for any operation where sulphur is injurious to the article being worked.

For furnace work, while a poorer gas can be made to cost less, it is not real economy to use such. A gas high in illuminants (C_2H_4) is heavier; and by its proper combustion a higher heat can be obtained in less space and in quicker time than with a lighter weight gas poor in illuminants—which is virtually the same as saying poorer in ethylene. Attention may be called to the high number of heat units in our gas, as compared with those in lighter weight and poorer gases. The Company's chemist, who has had large experience in furnace construction and metallurgical work, claims that it is more economial to use a fuel gas of high calorific value than to employ gas of one-third the value at one-third the price.

The reasons why the gas made by this process is far ahead of any other, and pre-eminently adapted as fuel for ingot, annealing, and open-hearth melting furnaces and all metallurgical work, are that the larger part of the material used in the manufacture of the gas is free from sulphur, and that it has a large percentage of ethylene and to some extent methane. At a low or common temperature, the affinity between the carbon and the hydrogen of the ethylene and methane is relatively weak for sulphur; but, as chemists well know, chemical affinities often radically change with the change of temperature. At high heats, the affinity of the carbon of the ethylene in our gas is stronger for sulphur than is that of iron; and as at high heats the ethylene is on the point of dissociation, it presents its carbon in a nascent state to the sulphur in the iron or in the gas, with production of carbon disulphide gas. This carbon disulphide, by the time it receives oxygen enough for its combustion to sulphur dioxide, is away from contact with the metal, and goes up the chimney before it can injure the steel. The excess of the ethylene and methane present during the first reaction to the sulphur would of itself determine the removal of the sulphur, as is often the case in many chemical actions where relative quantities of different elements govern decompositions and recombinations which follow their interactions.

By those interested in lime burning, the Company's process merits some attention, owing to the large percentage contained of hydrocarbons C_2H_4 and CH_4. As is well understood, but not satisfactorily explained, these hydrocarbons have a peculiar effect on entering the pores of the limestones, loosening them and, with the aid of heat, expelling the carbonic acid from the lime more thoroughly than can be done by the simple application of heat alone. These results are a matter of fact to practical men, and have been proved by the experiments of chemists. It is well understood by chemical authorities that the carbons of the hydrocarbons, being in a gaseous state, readily enter the limestones and combine with the oxygen of the carbonic acid therein, converting the carbonic acid to carbon monoxide—a gas having no affinity for lime or any other alkali. In other words, it is the percentage of ethylene in the gas made by this apparatus which is especially valuable for lime burning.

The question has been asked why we do not use peat and water alone. The answer is that we have not found it economical, on account of the large quantity of water it is necessary to use. The peat has only carbon enough for its own moisture in turning same into gas; and consequently the oil is added so as to make up the deficiency, and to keep the superheated steam from seeking the carbon of the coils and pipes.

To sum up, the apparatus has the following advantages over all other gas-generating plants:—

(1).—The moderate first cost of the plant and installation, and the elimination of the smoke nuisance.
(2).—The small space required.
(3).—The absence of complicated parts, and consequent nominal cost of repairs.
(4).—The requiring of but one fixing for the highest candle power. Other generating plants have to enrich during

two or more fixings to get high candle power. We, on the contrary, can reduce to any desired quality; and it is done during one fixing, without changing the emulsion.

(5).—The cleanliness of the operation.

(6).—The uniformity of quality, and freedom from sulphur and other impurities. Consequently, ours is an ideal fuel for gas-engines, ingot annealing and open-hearth melting furnaces, and also for all metallurgical work.

NEW HOLDER AT THE HYDE GAS-WORKS.

In order to meet the increased demand for gas which has taken place of late in the district of the Hyde Gas Company, additional storage has been necessary; and it has just been provided by a new gasholder, which was formally inaugurated last Wednesday. It is a three-lift telescopic one of cast-steel—the inner lift being 116 feet, the middle lift 118 feet, and the outer lift 120 feet in diameter, and each 24 feet deep; and its total capacity is 750,000 cubic feet. The guide-framing is composed of steel standards and girders. The height from the ground to the top is 94 feet; the total height from the bottom of the tank being 104 feet. The tank, which is also of steel, is 122 feet in diameter and 24 ft. 9 in. deep, 10 feet of it being underground upon a bed of concrete, 2 ft. 6 in. thick. It holds 1,750,000 gallons, or about 7850 tons, of water. The total weight of material used is 540 tons. As illustrating the progress of the Company's business, it may be mentioned that the quantity of gas sold in 1897 was 116,905,000 cubic feet, whereas last year it was 166,896,000 cubic feet; being an increase of 49,991,000 cubic feet, or at the rate of 43 per cent. The Company's chief officials and employees have all had long periods of service; Mr. Charles Potts, the Manager and Secretary, having been with them for 41 years, for nine of which he has filled his present position.

The Inaugural Ceremony.

There were present at the inauguration of the holder Mrs. Oldfield, the wife of the Chairman of the Company (Mr. Henry Oldfield, J.P.), Miss Annie Oldfield, Mr. E. W. Smith (the Vice-Chairman), several of the Directors, the Manager and Secretary and other officials, and Mr. William Newbigging, of the firm of Messrs. Thomas Newbigging and Son, the Engineers to the Company. The Chairman was unfortunately prevented by illness from attending. Miss Oldfield having named the new holder "Annie," in the usual manner, to the accompaniment of three hearty cheers, proceeded to the valve-house, where she turned the gas into the holder. In doing so, she expressed the hope that it would always be found useful, and that by it the Company would be better able to supply with gas the whole of the borough of Hyde and the surrounding districts. The company then returned to the offices, where refreshments were served.

Mr. E. W. Smith (the Vice-Chairman of the Company), who presided, said their first duty was to express their thanks to Miss Oldfield for the graceful manner in which she had performed the opening ceremony. They were also pleased to have Mrs. Oldfield with them. Their only regret was that Mr. Oldfield was prevented from being present, as nobody took a greater interest in the Company than he did. He concluded by referring to the satisfactory way in which the Directors discharged their responsibilities.

Mr. W. Newbigging, on behalf of the Engineers, asked Miss Oldfield to accept a handsome silver rose-bowl, bearing the inscription: "Presented to Miss Oldfield, on opening the valve of the new gasholder at Hyde, on May 22, 1907," as a small *souvenir* of the occasion. He explained that the new holder had been put in not so much with the idea of making profit as of making assurance doubly sure that the supply of gas to the town would always be properly maintained.

Miss Oldfield, in accepting the gift, thanked the company for the kind way they had acknowledged her small services.

The Chairman, in asking those present to drink to the health of Mr. Oldfield, said he remembered him remarking years ago that gas was a much better investment than any of the fancy lights. Next to his own business, it had been the best and most permanent investment he had made. They all wished Mr. Oldfield a speedy return to health.

Mr. G. F. Drinkwater, speaking in support of the toast, said that the official connection of Mr. Oldfield with the Company dated back to 1889, and during the whole of this period he had taken the keenest interest in the working of the Company. The business had steadily increased until it was considered desirable to erect another gasholder. The speaker referred to the length of service of several of the officials, and remarked that it showed that the relations between the staff and the Directors had been most cordial, and of such a character as ought to exist in every commercial undertaking.

The Chairman remarked on the satisfactory construction of the holder, and said the Directors exercised a wise judgment in their selection of the Contractors. Not only had they to thank them, but also Mr. Newbigging, who had saved the Company a great deal of trouble and anxiety. He hoped Mr. Newbigging would convey this expression of thanks to his father.

Mr. Newbigging, in reply, referred to his first visit to the Hyde Gas-Works, 25 years ago, in connection with the old holder. Messrs. C. & W. Walker, the Contractors who had built the gasholder, and Messrs. Tate and Gordon, who had carried out the work of excavation, had given every satisfaction.

In connection with a paragraph which appears elsewhere on the subject of the price of gas in New York, a statement was made in "The Tribune" last Saturday to the effect that the Attorney-General of that city has applied for a revocation of the Charter granted to the Consolidated Gas Company.

EVOLUTION OF THE INVERTED GASLIGHT.

(*Continued from p.* 527.)

Burners with Curved Tubes.

In all the burners hitherto described, except that designed by Kent and mentioned in the first section of this article, the tube of the burner is so constructed as to point vertically downwards. The plan of bending the burner-tube from a horizontal direction as proposed by Kent has the advantage of keeping the mixing-chamber cooler, especially if the combustion products are led away through an opening at the opposite side. Numerous makers have returned to the Kent system of construction, or provide their burners with doubly bent tubes, so that the gas-nipples point upwards, and the mixing-chamber is below the level of the flame. Experiments show that if the burner-tube is formed in the shape of an inverted U, a steady flame, causing the mantle to incandesce evenly all over, will be obtained by making the depending portion long enough; or for a gas pressure of about 2 inches by making it of equal length to the ascending limb. Vis has constructed a burner on these lines, with a depending limb 4 inches long. The portion of the tube joining the two limbs may be either a double bend or a pair of elbows, and upon the rising member may be placed a socket of insulating material. The Vis burner has a horizontal deflecting plate just above its orifice; and the globe is carried on a bracket from the ascending tube, so as to be capable of vertical adjustment. If it is desired, the globe may be closed underneath and an open cylinder be placed inside, so that the secondary air may be warmed by passing downwards through the annulus.

Good results are frequently obtained by carrying a pair of inverted burners on bent tubes, the ascending members of which are joined together Y-fashion and attached to the adjustable nipple of an ordinary upturned incandescent. Fischer also makes a single inverted burner for attachment to an upright nipple in a precisely similar manner. Bray has designed a burner-tube of two or more parts, each bent through a right angle, so that the whole can be fixed together and attached to an upturned, horizontal or depending fitting. Both Fischer and Bray have also constructed burners in which the globe, &c., is carried by the ascending member of the burner-pipe, while the mantle itself is supported separately by the detachable U portion of the tube—thus enabling a mantle to be lifted out and replaced without interfering with the rest of the burner. A burner has been brought out by Norden, and sold under the name of the "Colombus Lamp," in which the nipple and part of the burner-tube point obliquely upwards, the latter then curving down again so as to have an inverted mouth. The whole of the tube is contained within a spherical globe closed at the base, with an opening at the top for the escape of the combustion products and with a vertical opening at the side provided with a lip. A vertical plate is fastened to the ascending portion of the burner-tube, and is provided with screws holding the globe in position. This burner is largely employed as a multiple unit, several of them being attached to an enlargement at the base of a pendant. As practically the whole of the burner is inside the globe, and as the globe is not perforated underneath the general effect is that of an electric light.

Several inverted burners are constructed with tubes bent through only one right angle, so that the nipples and mixing-chambers lie horizontally just outside the path taken by the ascending combustion products. Some of them have an insulating piece on the tube protecting the nipple from conducted heat. The inlet ends of the tubes are either screwed straight for attachment to a horizontal gas supply or are provided with elbows for attachment to an upturned supply. When the latter is the case, a needle valve or the like is fitted at the elbow to control the gas. A burner constructed on these lines by Frister is fitted with a closed globe; the mantle being supported at a higher level than the lip of the glass, so that the secondary air enters below the place where the combustion products escape. Bachner's "Electroform" lamp is designed similarly, but its burner-tube depends obliquely. The gas supply is regulated by a needle valve with external handle, the primary air by rotating a collar, and a socket of some insulating material divides the burner-tube into two parts. The outlet end of the burner-tube is first bent horizontally and then vertically again, so that the mantle hangs within the oblique globe in the usual position for an inverted burner. The arrangement devised by Helps is too well known in this country to need description, beyond recalling the fact that the nipple is carried at the small end of a plug of a cock-like fitting, so that it can be cleaned or replaced without in any way interfering with the globe and mantle of the burner. In another arrangement having a like end in view, the nipple is carried by the casing instead of the plug of the fitting.

Several oblique burners are constructed in duplicate or triplicate on depending arms from a common upturned supply pipe. Those made by Ahrendt have the nipple and primary air inlets in the rising member; while those constructed by Proskauer are fitted with separate injectors on the descending pipes of each burner. In a complete oblique burner designed by Fried, the bunsen tube is surrounded by a closed jacket extended into the shape of a cone in its upper part; while the primary air enters through another cone, the apex of which joins the base of the conical jacket. All these obliquely disposed burners exhibit the defect that the ascensional force of the burning gas causes the

mantle to glow unevenly, only its upper part being properly heated. On the other hand, the sloping top of the closed globe allows the secondary air to enter at the lower side uncontaminated with the products of combustion. A burner has indeed been designed with a perfectly horizontal tube; the final orifice being drilled eccentrically, so that the stream issues in a slightly downward direction. As the mantle of this burner is also horizontal, it glows very unevenly, and the inherent advantage of favourable light distribution characterizing the truly inverted gas-burner, is sacrificed. A multiple burner designed by Gall consists of a vertical supply pipe terminating in a spherical vessel to which three or four inverted burners are attached by suitably curved pipes.

In order to avoid loss of pressure in the mixing-chamber, and also to ensure a thorough mixing of the gas with the primary air, Gall's common mixing-tube is fitted with several conical deflectors in an inverted position, arranged somewhat after the fashion of the baffles in a steam injector. A multiple burner designed by Darwin contains two different inlets for primary air. The pendant tube of the fitting is attached directly to the nipple, below which a vertical, outwardly cylindrical structure hangs. A small proportion of the needful primary air enters through holes at a level with the nipple; and the mixture so produced descends through a parallel tube in the centre of the structure down to the base, where it enters a wider flat chamber. This chamber has holes in its upper portion admitting the gas and air into the annular space of the structure; while holes in the outer casing permit the entry of a second proportion of primary air. The whole mixture so produced rises in the annulus through a gauze to an enlargement of still greater diameter in the upper part of the structure, whence it passes by leading tubes to the appropriate number of burners. The area of the upper air inlets is controlled by a revolving collar; that of the lower by a revolving milled head. The actual burners of this apparatus are perforated non-metallic cones extending well down into the mantles. At the spot where the globe gallery is fixed, a sleeve of non-conducting material is placed in the tube; but as the metallic tube is continuous, much heat is communicated from the flame to the structure where the gas is mixed with the primary air.

Every multiple burner hitherto described exhibits the defect that all its units must be lighted or extinguished simultaneously. Darwin, however, has constructed a burner in which the main vertical pendant ends in a hemispherical receptacle, from which as many tubes (each fitted with its own stopcock) descend to a fitting where the corresponding number of nipples and their respective inlets of primary air are situated. If preferred, however, this main portion of the burner may be inverted, a continuation of the original gas-supply pipe leading downwards to a cup at the base of the fitting, whence ascending pipes, with stopcocks, lead each to its own injection chamber at the top.

Many of the foregoing burners exhibit another defect, inasmuch as the nipple cannot be cleaned without taking the whole burner to pieces and removing the mantle. Helps has designed a distributing fitting for a multiple unit in which the nipples are carried on a short length of tube that can be withdrawn by unscrewing it in one place and removing a bolt in another. Another method of rendering the nipples of a multiple unit accessible for cleaning without interfering with the burners themselves, consists in making the common injection chamber in the form of a sphere, the lower half of which can be unscrewed, while the upper half, which carries the nipples, the arms leading to the burners, and the stopcock, is fixed to the flexible or rigid depending pipe of the whole fitting. A still further improvement consists in attaching the nipples to a fitting which makes a friction-joint with the outlet of the main depending pipe; its correct position being ensured by a bayonet joint. Hence after removing the lower hemisphere of the mixing-chamber, the volume of gas passing each individual nipple can be adjusted by an exposed setscrew, or the fitting carrying the whole of the nipples can be withdrawn for cleaning, with the certainty that when replaced each nipple will point to the centre of the burner-tube belonging to it.

Mantle Supports, &c.

It is a matter of some considerable importance in an inverted burner that the fitting holding the mantle at the mouth of the burner-tube shall be so designed as to ensure the mantle hanging vertically, being concentric with the tube, and being unable to swing. When the mantle-rings used some time ago were constructed of metal, various arrangements were proposed for locking the burners into their place by a combination of dovetailed and bayonet-like joints. It was soon found, however, that mantles carried by metal rings were quickly injured, owing to the repeated expansion and contraction of the metal when the burner was lighted or extinguished. Hence mantles are now usually attached to magnesia rings. In some burners the tube is fitted with horizontal pins, over which circumferentially arranged hooks projecting above the mantle-ring drop; in others, the burner-tube has radial U-shaped ledges on which horizontal radial arms on the mantle rest; in others, the pins on the burner-tube are triangular, and A-shaped radial pins on the mantle-ring drop over them—arrangements that are, of course, capable of numerous modifications. Farkas has felt it necessary to employ some more complicated method of attachment, so as to prevent all danger of a mantle falling from the burner tube when employed for such purposes as railway carriage lighting. He therefore now fixes round the burner-tube a pair of rings joined together at two or more places by connections parallel with the bore of the tube; the lower ring being also fitted with slots. In attaching a mantle, the internally projecting pins on the ring have to pass through the slots in the lower collar, then have to be raised further and rotated until they pass slots in the connections between the two collars, when finally the mantle drops again into a position from which it cannot be displaced by any vibration. Altmann has designed an arrangement for a similar purpose, which consists in a screwed flange on the burner-tube, descending and nipping the brackets on the mantle ring against corresponding pins on the burner tube.

Difficulties often occur in replacing a mantle when it is attached to the burner by means of a bayonet joint consisting partly of metal and partly of magnesia. Liais and Glinicke have attempted to obviate this by carrying the mantle on the globe or an attachment thereto, instead of suspending it from the burner; while Reinhold has adopted a somewhat similar plan. In the Eckel and Glinicke lamps the projections of the mantle rings rest on the gallery of the globe; while the gallery is carried on two hooks from two screwed pins fastened to the burner-tube—lock-nuts being provided to prevent the globe swinging. In a further modification of the same lamp special provision is made to ensure the globe and the mantle carried by its gallery hanging strictly vertical. Projecting upwards from the flat top of the gallery is a pair of U-shaped struts arranged radially. The inner member of each pair has a vertical slot cut in it which rises round two pins disposed one above the other on a stirrup hanging from the burner tube. This burner is used with a closed globe; the secondary air entering through lateral apertures in the gallery and being diverted downwards towards the apex of the mantle by means of a suitable deflector; while the products of combustion escape from openings in the stirrup. In the Kindermann burner accessibility of the mantle is also achieved by supporting it with the aid of divergent projections on its ring which rest against the top of the globe gallery. The gallery in this burner is carried on an open stirrup fastened to a sliding collar on the burner-tube, a milled head serving to fix the collar at the proper height. On loosening the screw, the globe gallery drops so far as to leave sufficient space between it and the mouth of the burner-tube for the insertion of the mantle. In the Jacob burners, the mantle is carried by the globe gallery in a similar fashion, but the gallery is hinged at one side to the conical hood of the burner. In more recent models the mantle ring is carried by an intermediate detachable ring-shaped support, which drops into the globe gallery and is fixed in position by a bayonet joint. The Wolff burner is constructed in the same way; the gallery being hinged from one end of a depending stirrup carried by the descending member of the curved burner-tube. A screw on the other half of the stirrup keeps the globe in its proper place.

(*To be continued.*)

OPERATING CARBURETTED WATER-GAS PLANTS

At the Annual Meeting of the Illinois Gas Association, a paper on the "Best Methods of Operating Water-Gas Machines" was read by Mr. William I. Battin, the Superintendent of the South Station of the People's Gaslight and Coke Company of Chicago.

At the outset, the author acknowledged that his paper did not contain anything new to the members; but he explained that it had been prepared, at the suggestion of the Secretary, in such a way that the men who actually work carburetted water-gas plant might find in it directions as to how to do it, and learn why it should be done in the way recommended. His first advice was that, before the plant was fixed up, the workman should go through all the operations of changing the valves until he was quite sure he knew exactly how it was done. But even if he understood the operation of the plant, he could not work it to advantage unless he knew something about its construction. The author therefore devoted the first portion of his paper to some remarks upon the plant and the materials used in it. He pointed out that the generator should permit a fire, when coke is used, of from 7 to 9 feet in depth. There should be sufficient chequer brickwork that when No. 1 square bricks are used, spaced 2½ inches apart, there will be about 200 of them for each square foot of grate surface. There should be a blast pressure stiff enough to maintain from 16 to 18 inches under the grate when the fire is being blasted. The stack-valve opening should be large enough to cause not more than 3 inches pressure on the space under it when the plant is blasting freely; and the openings between the different parts of the plant should be as large as the stack-valve. The speed of the blast through the fuel should be such that the difference in pressure between the bottom and the top of the fire at the middle of any blasting period (when the secondary blasts are on) should be about 3 inches for oven coke, 4 inches for gas coke, and 6 inches for large, clean anthracite. The oil should be evenly sprayed over a large surface of the chequer brickwork, and it should have at least 3 feet of space arranged between the spray and the bricks to spread out and thoroughly intermingle with the blue water gas. The steam can be of any pressure; but it must be fairly dry, and the pipes large enough to admit a great excess of steam when necessary. A cock should be placed between the throttle-valve and the plant, and a gauge on the line between the valve and the cock, which should be so set that by carrying a pressure (say) two-thirds of the lowest that

the boiler pressure will ever get, the proper amount of steam will be admitted.

As it is sometimes desired to see what kind of blue gas is being made, a hole should be tapped between the generator and the carburettor, where either the up-run or the down-run gas will be caught. The workman should put on an ordinary ⅛-inch pet-cock, and provide a pilot-light to keep the blue gas burning. If the gas is allowed to come out at such a rate that the flame will be only about 4 inches long at the start of the run, the gas ought to burn throughout the run. If it goes out, it shows excess of steam or other bad conditions. This pilot-light should not be necessary if short runs are made; but if long runs are tried, it will show how the blue gas deteriorates after the first few minutes of a run. The gas take-off pipe should be so large that, even when 2 or 3 inches of lampblack have accumulated on the inside, there will still be no excessive back-pressure on the plant. It should not exceed 20 inches; and the lower it is, the better. The syphon gauges used must be of such length that they will never blow out while on the run, otherwise the gas maker will keep them shut off all the while. The gauge pipes should be not less than 1 inch in size; and just below the shut-off cock on the gauge live steam should be connected to each pipe to free it from tar and dirt.

All openings on the plant should be provided with a sufficient number of bolts, so that the breaking of one will not allow the doors to fly open. Safety plugs of the full size of the blast-pipe should be lightly driven into the ends of it. These will blow out in case of explosion, and stay out until they are put back again in position. Flaps which fall back again into place should not be used, or the contraction instantly following the explosion will probably break the pipe. An opening should be left in the blast-pipe just outside the carburettor valve, and the air coming out from this point should be piped to where the gas maker can see it, so that if gas is getting into the blast-pipe through leaky valves it will show.

Almost any oil can be used, provided the heats are kept right. On the other hand, there is no point in the handling of a water-gas plant of more importance than good fuel. It should be dry, should not be smaller than 4-inch cubes, and should be of uniform quality from day to day. Poor fuel is bad enough; but changing from day to day is worse. Where poor or small fuel must be used, it should be mixed with some of better quality. The fire-bricks, whether for lining or for chequering, need not be of high grade. Almost any will do, provided they are of uniform size, and not too easily broken.

Before firing-up a generator, the workman should be certain that water is overflowing from the seal-pot into the little overflow-pot, which must be kept quite full. This stream of water should be flowing as long as the plant is under fire; but it should be checked down as closely as possible. When once the heats are right, the surface of the overflow-pot should not contain any scum; but if the plant gets dirty or too cold, a foamy tar will show immediately upon the surface of the water. A thin brownish tar is a sign of bad working somewhere.

When commencing operations, a sufficient number of slabs of wood are put on the grate of the generator to make a pile about a foot thick; and on this coke to the depth of a couple of feet is shovelled. Then oily waste is stuffed in round the wood. All the blast and other valves are kept shut, and also the gas-valve at the outlet from the seal-pot. The stack-valve is, of course, left open. The pilot-light at the stack should be lighted. The coaling-door should not be closed tight, because after a draught is once started, the volume of air being drawn in will burn any combustible gases that may collect above the fire, and prevent an internal explosion. A little coke can be added every few hours, as fast as the fire heats up; and the bottom doors can be kept just "cracked" by closing them against a piece of tin. If it is desired to heat the fires up more quickly, the doors should be opened a little more. The fire should be not more than a couple of feet in thickness while draughting up the set. It is well to have a hole through the fuel, so that if a bottom door is opened one can look up through the hole over the top of the fire. There is very little danger of overheating the grate-bars; but if, on opening the bottom doors, they appear to be melting hot, a little steam admitted under the grate will prevent injury to them. The bottom doors should never be opened without turning on a little steam under the grate.

Before putting the plant on blast, the generator should be filled with coke up to the top, then the bottom doors and the coaling-door should be closed, and all the dirt wiped from the joints. The generator blast can now be cautiously put on full. After 10 or 15 minutes, a little steam can be turned under the grate with the blast. This will protect the bars, and get the heats up more rapidly in the chequer brickwork. The first blow can be about 20 minutes. Then the blast-valve can be shut and a steam run made, which means that the gas-valve at the outlet of the plant is opened and the stack-valve closed. Then the regular amount of steam is put under the grate, and the resultant blue gas is sent over into the holder. As the blue gas affects the candle power badly, some operators allow it to burn at the stack. This, however, will make it red hot. The run will last six minutes, and then the steam can be shut off and the plant blasted up again for ten minutes or so. When two or three alternate blows and runs have been made, there will be heat enough in the carburettor chequer brickwork to enable, on the next blast (if the carburettor secondary blast is slowly raised a little), the gases from the generator to ignite, and then the carburettor blast-valve can be raised high enough to burn all the gases. The secondary blast must not be kept on, however, unless it is certain that the gases are burning in the chequer bricks, which will cause a blue flame to be seen by looking through the sight-cock into the oil chamber. After two more such steam runs, the carburettor will be showing some heat; and then the secondary valve can be raised less, and the superheater secondary cautiously raised so as to burn the gases in the superheater and thus heat it up. The workmen must be sure that the gases light in the brickwork; if they do not, the cool air will cool off the bricks rather than heat them up.

All this time the plant will not have turned out any good gas; but as soon as the heats are a bright red in the carburettor and the superheater shows some heat, the regular blasting and running can be started. The outlet-valve from the machine is opened, and an eight-minute blast made; then the regular amount of steam can be turned on to the bottom of the fire and the blast closed—the superheater first, the carburettor next, and the generator last. The stack-valve must be cautiously closed; the pressure-gauges being watched to see that no excessive back-pressure is shown. When the stack-valve is closed, the plant is on the run, and the blue gas is going out through the seal-pot into the holder. The oil is now turned on at such a rate that in five minutes the amount for one run will have been put in. As the make of gas per run increases after cleaning, some operators use 10 per cent. more oil for the first four or five hours after cleaning than they do for the rest of the time up to the next cleaning. When the oil is turned on, the pressure-gauges must be watched. The oil should be put in fast for the first two or three minutes, and be all in in five minutes, so that a full minute of steam run can be made to purge out any oil. At the end of the sixth minute, the steam is turned off and the stack-valve raised. The blast-valves are then cautiously raised—the generator first; then, after a minute or so, the carburettor; and the superheater last. The blasting is continued at eight minutes intervals, and the run at six minutes. Soon the carburettor will show a bright red heat, and the superheater, if anything, will be a little hotter.

When this condition has been reached, as long as the plant is kept running, the superheater blast-valve will probably never have to be opened again, as the superheater will keep hot enough. But the carburettor blast-valve must be opened at each blasting period—just a little at first, to be sure that it lights, and the opening gradually increased towards the end of the blast, so as to burn all the gases, leaving only the occasional flicker of blue flame at the stack. The heats will soon be such that a five-minute blast, using the secondary air in the carburettor only, will be long enough. At the end of each hour, the generator must be filled with fuel. This is done immediately after a run; the generator blast being put on, however, for a few seconds, to drive the run gases out. Then the blast-valve is closed, and the coaling-door opened. The first steam runs should be all up-runs. After them there should be one down-run made for every three or four up-runs if the fuel is good, and more if it is bad. When the machine is on a down-run, it must be changed over to an up-run before the run is taken and blasting started again. With a six-minute run and a five-minute blast, there will be about five runs made each hour (allowing five minutes for coaling, &c.).

After the plant has been running for twelve hours, the gas-valve should be closed and the fire cleaned. This is done by blowing it out, the same as before coaling up; and, instead of opening the coaling-door, a little steam is put on the bottom, and the bottom doors are opened. The stack-valve should then be closed. If there is no steam leaking in above the fire, the amount of blue flame which will come out of the cleaning-doors will be quite negligible. If the stack-valve is not closed, the draught will make the fire melting hot, and throw the heats in the chequer brickwork out of balance. The clinker should not be cut up into small pieces by a punching movement with the light bars. But, instead a very heavy bar of large diameter, 3 feet from the chisel end, and tapered towards the point and the handle end, should be pushed under the centre of the clinker between two grate-bars. Then the handle end should be raised high, and jerked down quickly. The shock will break the heaviest clinker. By repeating this movement, all clinker will be broken up into large pieces which can be pulled out of the fire. The whole idea is to get the clinker out, and keep the fire in. Of course, all fuel which falls out is freed from clinker and used again. But no matter how carefully this is done, the generator fuel used per 1000 cubic feet of gas made will run up very fast if much fuel is drawn out during the cleaning. That is one of the serious objections to bad fuel. The ashes are then cleaned out from under the grate, the stack-valve opened, and the bottom doors wiped off and shut. The plant is then ready to be coaled up for another run, unless there are clinkers adhering to the side walls of the generator. When there are, the coaling-door must be opened, and the clinkers knocked off. After clinkering, the fire is coaled up full, and an extra long blast (eight or ten minutes) is made before the running is resumed. Clinker can be kept soft by using lots of steam and by making few down-runs, and especially by using a little steam while blasting. All these devices tend to make a dead fire, and should be avoided. A fire to be right should be such that after a four or five hour run, when the bottom doors are opened the clinker will show red hot in spots. If no fire can be seen, it will show it is being killed; and probably side clinker instead of bottom clinker is being made. Where a generator has no up-and-down make, the fire can be kept down on the grate only by cleaning every three

or four hours. No matter what the type of plant may be, the shorter the runs the better. They should be about six minutes long—seven or eight minutes at the most, though in extra cold weather it may be necessary to lengthen out the run, keeping the oil-valve open—admitting a large quantity of oil when the plant is making but little blue gas, so as to hold up the candle power.

Having described what the fire in the generator is like, the author passed on to explain the method of cleaning the take-off pipe and the seal-pot, which will require attention every two or three months if the plant is run properly. He afterwards pointed out that the principal precaution to be observed in operating water-gas plant is never to go on a run with the blast-valve open, or the gas will get back and blow up the blast-pipe. Whenever it becomes necessary to quickly take the plant off the run, owing to back-pressure or other trouble, the oil-valve should be closed first, and then the steam-valve. In an emergency, however, the stack-valve can be raised before either the oil or the steam is shut off. He said many seemingly mysterious occurrences could be explained by one of the preceding statements.

The next matter considered was the combustion of the fuel when the blast is on, with which the author dealt at some length. He then took up the subject of the way in which the oil is introduced, on which he made the following remarks: The oil must be so put in that it is spread over the whole area of the chequer-brick. If it is put in in spots, these will get so cold as to be black, and the rest of the chequer-brick will be getting white hot. In a short time this will clog the bricks with carbon, and the oil will run down in a stream and ruin the condition of the whole plant, not to mention the great loss in efficiency. If the bricks get coated over badly or slagged or run together or crumpled up, or a bunch of carbon forms under the spray, this must be removed at once, and this carbon or bad brick taken up, so as to again expose good clean brick to the oil. The moment anything goes wrong with the oil spray, it must be taken out and made right. Nothing will spoil a good plant more quickly than to have the oil entering the wrong way. If oil is heated even to 250° or 300°, just a little of it turns to a vapour; hence with hot oil this vapour, issuing from the nozzle together with the liquid oil, causes a more effective spray, and this is about the only advantage of heating oil. If oil is to be heated, it must be measured before entering the heater. The oil ought not to be admitted immediately after a run is put on; but the blue gas should be allowed to circulate for a few seconds, so as to take the sharp heat off the bricks. The oil ought to be forced in the first half of the run as quickly as possible, and then gradually slacked off when the make of blue gas is falling off. As stated, a minute of steam must be made at the end of the run, to carry out any oil lying in the plant.

Mr. Battin emphasized the point that the plant should be provided on the top of the seal-pot with a tap from which a pipe should be led to a spot where the operator, by opening a cock, can see exactly what kind of gas he is making each run by letting it blow out for a few seconds. A run should never be made without watching the colour of the gas. When the plant is in good condition, the colour of the gas will be rich yellow. If it is whitish, the gas is not properly fixed; if it is brown, some of the oil is being over-cracked; and if the machine is making lamp-black in excess, the gas will appear dark brown or even black. By allowing a small stream of gas to impinge on a piece of white paper, or better still on a bright trowel, the presence of lamp-black or free oil can be seen at once. The trowel test will also show any excess of steam. When the steam is right, there will be just a slight dew on the trowel.

The author next dealt with the subject of re-chequering the plant, which he said should be done every thirty or forty days in the case of plant run continuously, and for those run intermittently. If there was any reason to suspect that plant was not working well, there should be no hesitation about taking out the brickwork and replacing it. If the bricks were in good shape, they should be simply dusted and replaced, and very few new ones were needed. Only those that were glazed or slagged should be rejected. The cost of re-chequering was small; but a slight reduction in oil efficiency would run the operating cost up very fast. Unfortunately, it was not length of time alone that caused plant to depreciate in efficiency. Plant just re-chequered might be spoiled the day it was put up by wrong handling, or by trouble with the oil spray or very bad fuel.

In conclusion, Mr. Battin pointed out that water-gas plant has a peculiarity common to all machines. You may build a row of them exactly alike, and connect them up in exactly the same way, chequer them alike, and try to run them alike; and yet there is always a difference in them, and one machine is always the good and another the bad one in a generator-house. Just as it is difficult to explain and correct such a difference, so it is difficult to describe a method of running that exactly fits all cases. Consequently, the gas maker must learn to know his machine and its peculiarities.

[Accompanying the paper was a bibliography of the subject.]

According to "Power and Transmission," the "bucking and snorting refusal to start" of the gas-engine is often due to moisture in the cylinder, preventing regular ignition till dried by the heat of several explosions. The difficulty may be obviated by shutting off the cooling water for a few minutes before stopping the engine, and not turning it on again until after the engine begins to explode regularly when it is again started.

A NEW PROCESS FOR MAKING MANTLES.

A recent issue of the "Journal für Gasbeleuchtung" contained a paper read before the last meeting of the Silesian Association of Gas and Water Engineers, in which the author (Herr Bruno of Berlin) sketched the development of the incandescent gas mantle up to the present time.

In its early days, he said, the mantle was made by impregnating a knitted fabric of cotton or ramie with a solution of thorium nitrate. When it was attempted to employ artificial fibres instead of the cotton, difficulties arose owing to the fact that the latter materials had not the absorbing power of the natural fibres. Hence it was found necessary to incorporate some thorium nitrate with the viscid solution from which the artificial fibres were prepared by a process of extrusion. But, although this method yielded thoroughly good mantles at the time it was proposed, it has not been employed on a large scale, probably because it was troublesome and expensive to work. Afterwards, however, an artificial fibre—*i.e.*, copper-cellulose—was discovered to be capable of absorbing a solution of thorium nitrate; but when mantles were produced in this manner, they fell to powder immediately they were put on the burner. After prolonged experiments, it was observed that a satisfactory mantle could be made from copper-cellulose by impregnating it (after being knitted into the proper shape) with a solution of thorium nitrate, and then decomposing the salt within the fabric by treating with ammonia, so as to produce thorium hydroxide.

This method of manufacture has numerous advantages. In the first place, thorium salts are known to be hygroscopic; so that when mantles made from them are supplied (as is usually the case with large consumers) without being burnt-off and collodionized, they have the defect of greedily taking up moisture from the air. Besides, if a mantle becomes damp, it loses its proper shape when it is placed on the burner and the gas is lighted. Mantles made of copper-cellulose impregnated with thorium hydroxide precipitated *in situ* are naturally free from this hygroscopicity. They can indeed be soaked in water for hours without losing any of the earths. Thorium nitrate—the only thorium salt hitherto used in preparing mantles—has the property of swelling enormously when it is being converted into oxide by ignition. So much is this the case that a piece of the nitrate about the size of a pea heated in a 20 c.c. platinum basin expands sufficiently to overflow the vessel. This property is still used as a test for the quality of thorium nitrate; for it is believed that a salt which swells largely on ignition will not sinter when present in a mantle. In the second place, mantles of copper-cellulose impregnated with thorium hydroxide are much stronger than others. Tested in the Drehschmidt machine, an ordinary mantle will bear at the best only some 90 or 100 shocks, whereas a copper-cellulose mantle will not be injured in the least by 2000 or 3000 shocks. In the third place, an [uncollodionized] ordinary mantle will not bear touching—breaking off at the head; but a copper-cellulose mantle impregnated with thorium hydroxide will often resist some considerable amount of force.

Instead of using ammonia as a precipitant, hydrogen peroxide may be employed. This reagent throws down thoria but dissolves ceria. Hence it is necessary first of all to treat the hydrogen peroxide with such an excess of cerium compounds that, when it is used to precipitate the thoria, the finished mantle contains a proper proportion of ceria. When this last process is adopted, the mantle does not contain thorium oxide in the usual form—viz., as ThO_2—but contains a higher oxide—Th_2O_7; and mantles so prepared often exhibit an illuminating power of from 130 to 140 Hefners, instead of the 120 to 130 Hefners, which is characteristic of mantles made in other ways when tested under identical conditions.

Society of Engineers.—At the ordinary meeting of the Society next Monday, a paper on "Working Experiences with Large Gas-Engines" will be read by Mr. Cecil A. St. George Moore, B.A. The author will deal first with the various types of engines and then discuss the merits of those of the two and four cycle type. The rest of the paper will be devoted to remarks on the cracking and wear of cylinders, the cambering of piston-rods, the stratification of gaseous mixtures, ignition and pre-ignition, the utilization of waste heat, and producer gas.

Italian Gas Society.—The annual meeting of the Society will be held on the 17th, 18th, and 19th prox., in the Vestibule of the Municipal Theatre at Bologna. Signor Ing. F. Rebuffel, the Engineer of the gas-works in that town, will preside over the Conference, and his works will be visited in the afternoon of Monday, June 17. The morning of that day will be taken up with the usual official business of the Society. A proposal will also be made to admit water engineers as members of the Association Questions of taxation and other legal matters are to be discussed and the technical items are the following: "Utilization of Bye-Products;" "Use of Gas for Central Heating;" "Methods of Overcoming the Effects of Naphthalene;" "Water Gas and its Carburetting;" "Vertical Retorts;" and "Gas Leakage." On the third day, experiments are to be made on the fraudulent abstraction of gas from meters. The congress will be brought to a close with the usual annual dinner.

UNDERGROUND WATER.

At a recent Meeting of the Surveyors' Institution, an interesting paper—the joint production of Mr. W. VAUX GRAHAM, M.Inst.C.E., and Mr. HAROLD F. BIDDER, Barrister-at-Law—was read on the above subject, dealing specially with certain recent enactments affecting water rights. We give some extracts from the first part of the paper, and reproduce in full the portion in which the authors dealt with the matters to which they wished to direct particular attention.

The general subject of underground water was brought under the notice of the Institution in March, 1900, by Mr. J. Shiress Will, K.C., who read an interesting and valuable paper, in which he examined the existing law in regard to the matter, and gave an account of the principal cases that had been decided.* In the discussion that followed, it was freely suggested that the working of the law involved at times great hardship, and was far from satisfactory; and a tendency was noted among Parliamentary Committees to seek to minimize these hardships in individual cases that came before them. Since then this tendency has been very considerably developed; and the authors endeavoured to trace the extent to which Parliament has, in Private Bills, modified the law, and the reasons which impelled its action.

Dealing first with the rights in underground water at common law, the authors summarized as follows the effect of the cases cited by Mr. Shiress Will: (1) Every owner of land is owner also of everything between the surface of his land and the centre of the earth, including all water that may lie or be flowing or percolating there, with the sole exception of water flowing in a defined and known channel. This ownership of water, however, only exists so long as the water happens to be under his land. He has no right to retain it there. (2) As a consequence of this ownership, he may, by pumping, attract the underground water from under his neighbour's land, though by so doing he does his neighbour the greatest damage. Such damage is *damnum sine injuria* —"hurt, but not legal wrong;" and his neighbour has no remedy, except possibly in the case of a right to have the surface of his land supported by underground water, which may perhaps be gained by prescription. (3) But if the underground water flows in a known and defined underground channel, then the same law applies to it as to a river on the surface—viz., each owner through whose land it passes must allow it to flow unimpeded, and may only abstract from it a quantity of water sufficient for his reasonable use.

Proceeding to cite some recent cases, the authors first directed attention to two important ones which have been decided since 1900. The first was *Bradford Corporation v. Ferrand* (1902), dealing with the "known and defined" underground channel.† No case on this point had previously been decided in the English Courts, though there had been two cases in Ireland, both of them referred to by Mr. Shiress Will. The plaintiffs in the Bradford case were riparian owners on a certain stream, one spring of which rose upon defendant's land. He sank a well, and intercepted the water that would otherwise have risen in the spring, thereby diminishing the flow of the stream. The intercepted water was to be used by an Urban District Council. Mr. Justice Farwell assumed for the purpose of his judgment that, as the plaintiffs alleged, the water flowed to the spring in a defined but unknown channel; and he decided that the defendant was within his rights. His Lordship said:

> No one can tell where or in whose land this hypothetical stream runs. If the plaintiffs are right, no proprietor of land above the spring can sink a well or make excavation on his own ground without the risk of incurring liability, possibly to a very large amount, to the plaintiffs, for interfering with the spring. This is a much larger liability than was unsuccessfully sought to be established in *Chasemore v. Richards;* for a defined underground stream may flow for miles, whereas the gathering-ground of water penetrating by percolation is of comparatively small extent.

The authors pointed out that, in basing his decision on the prevailing ignorance as to underground water conditions, and the impossibility of asserting or defining rights in the unknown, the learned Judge took the foundation upon which the whole law as to underground water is raised. A right in underground water is regarded as something too intangible to be protected by rules of law. It might, so to speak, "materialize" at any time in unexpected places, and could not be acknowledged in practice without introducing great confusion and uncertainty. On the other hand, it may be said that our knowledge of underground water conditions is constantly improving; while the ever-increasing demand for water renders the existing anomalies more and more burdensome. The other case was that of *English v. Metropolitan Water Board*, recently tried by the Lord Chief Justice; the facts of which were reported in the last volume of the "JOURNAL" (pp. 291, 473). The authors thought this case was particularly interesting, owing to the exhaustive discussion it contained of the effect of pumping in a chalk area. His Lordship found that the water pumped by the Board (1¾ million gallons a day) was not derived from the surface water, but from "a vast underground body of water flowing through the fissures of the chalk." His judgment is, however, to be appealed against.

* See "JOURNAL," Vol. LXXV., p. 737.
† *Ibid.*, Vol. LXXX., p. 502.

The authors next went on to show that a water company should be differentiated from an ordinary landowner. They pointed out that there is an inherent right in every landowner to take the water underneath his land, and that with this right necessarily goes a power to injure his neighbours, under the protection of the law; the magnitude of the injury and the bounds of its action being solely limited by the scientific apparatus at the disposal of the landowner. In the case of the ordinary landowner, however, there is no inducement to lead him to make more than a moderate use of his right. Even if he were to obtain an enormous quantity of water, he has no means of disposing of it. Moreover, it rarely happens that the water is removed from the watershed to which it belongs; and this fact reduces very greatly the injury it is possible his operations may cause, as, with a loss that is greater or less according to the purpose to which it is put, the water is returned to the river it would naturally feed. Before water can be conveyed any distance away from the site upon which it is found, it is necessary to lay continuous lengths of mains; and this immediately brings the landowner face to face with his neighbours and the local authorities whose interests are affected, and compulsory powers have to be sought. But while it may be necessary to subject A to some disadvantage in order that B may have the proper use and enjoyment of his land, it is quite another thing to enable B to injure A indefinitely, and without compensation, for the benefit of an unlimited and possibly distant class of third parties. Thus it is that the case of water companies and similar bodies whose object it is to obtain large quantities of water for distribution, is wholly different from that of the ordinary landowner. Their one purpose is the exploitation of the right which, even in private hands, works at times some hardships; and they are created with special facilities for this, such as no ordinary landowner can possess. A possibility that the ordinary law should be modified in dealing with large distributing agencies was suggested by Lord Wensleydale in 1859, when giving his judgment in the House of Lords in the now historic case of *Chasemore v. Richards*.

Crossing the Atlantic, the authors proceeded to inquire how the difficulties they had been considering are being dealt with in America. In the Courts, the English common law is administered, and English cases are quoted; and in most of the underground water cases *Chasemore v. Richards* is discussed. But while American lawyers would probably, on the whole, agree that the strict interpretation of the common law is that placed upon it in England, a tendency is manifesting itself to develop a doctrine of "reasonable use." According to this, a man may take all the underground water he can get for all reasonable purposes in connection with his land and the proper enjoyment of it; but these purposes do not include the removing of the water for use by other people at a distance. This principle was contained in Lord Wensleydale's suggestion already referred to. The authors cited several interesting cases, and expressed the opinion that the doctrine of "reasonable use" (which, by the way, is not universally accepted in the American Courts) would not be listened to for a moment in England.

Before proceeding further, the authors thought it would be convenient to inquire into the action of powerful pumps, withdrawing large quantities of water, upon the water system of the surrounding neighbourhood; and they did so under two heads: (1) When underground reservoirs are drawn upon; and (2) when underground moving water is impounded on its way from one place to another. On this subject, they made the following remarks: Considering first the effect of drawing upon the water which has collected in the lower strata below the level of any natural outlet, the theory is constantly advanced that with an inexhaustible supply to draw upon no injury can ensue from the most powerful pumping. This theory, in the authors' opinion, cannot be supported by the evidence of experience; and an interesting example of its complete breakdown will be given later on. The case of *English v. Metropolitan Water Board* (already quoted) is also a striking instance of deep-level pumping affecting the upper subsoil water. There can be no doubt that in such cases springs and wells are affected not only in the vicinity of the deep well, but sometimes at long distances away—the support afforded by the deeper water being withdrawn during the period of pumping.

The effect of heavy pumping from the moving body of underground water is upon the wells and springs below, and not to any great extent upon those above the point of pumping—unless, of course, it is attempted to obtain more water than the gathering-ground will supply. It is therefore of importance to know the direction in which the underground water is moving, because disastrous results may be expected to follow from heavy pumping operations carried on up-stream of the natural outlets. This applies more especially to the chalk and similar formations, where the water gathered from large areas has already collected in considerable volume and is moving along through fissures. By pumping on the line of flow in such a district, water can be abstracted in much greater quantities than when it is moving dispersedly through pervious strata; and the wells and springs which it should have fed can in some cases be wholly deprived of it. Thus it comes that a river rising from the chalk is vastly more assailable than a river the immediate product of surface drainage, and therefore fed by innumerable small tributaries, or by water oozing directly into it through the banks. In the case of the chalk stream, all its "eggs" are, so to speak, "in one basket;" and that basket lies at the mercy of the enemy, and

knows no protection from the law. In fact, the water which will later be the river is already collected underground, though not in such known courses as the law will acknowledge; and by a single lucky boring half the flow of the river may in all likelihood be stopped.

It will be convenient now to trace in detail the growth, as exhibited in Private Acts, of a feeling in Parliament that, in conferring landowners' powers on bodies collecting large quantities of water for distribution, some protection should be afforded to those whose water supply will be affected by extensive pumping operations. As has been pointed out, the general ground of such a claim is that, while the adjoining landowners have no legal right to retain the water themselves, the power of the distributing body to injure them is a wholly abnormal one, and is derived from special attributes conferred by Parliament itself. While no change of the existing law may yet be advisable or practicable, Parliament may well examine closely what will be the result of the exercise of their rights under that law by the artificial bodies it creates. A recognition of this obligation is found in the Standing Order of the House of Commons (134D) giving power to the Referees on Private Bills to admit petitioners against a Bill who allege that, under the provisions of the Bill, any water or water supply of which they may legally avail themselves will be diminished or injuriously affected. By this Order, the power of the Referees to admit petitioners is made quite independent of the prospective injury being one that the law will recognize.

As might have been expected, the first to claim protection were existing water companies, who feared an attack upon their sources of supply. The form of protection in these cases has usually been to prohibit the promoters or undertakers from sinking wells within a certain distance of existing wells of water companies, or within certain areas. The grounds of protection in such cases are, no doubt, somewhat different from the grounds upon which an ordinary landowner seeks it. Parliament having created a body for the purpose of obtaining and supplying water, and laid them under an obligation to do so, may feel it incumbent not to diminish the sources of supply of that body.

The case of the Wey Valley Water Act, 1898, was referred to in the discussion on Mr. Shiress Will's paper. The promoters were there prohibited from sinking wells within three miles of the existing wells of the Aldershot Gas and Water Company. This prohibition, however, was inserted by agreement. Similarly, in the Limpsfield and Oxted Water Act of 1902, the Limpsfield Company were debarred from sinking wells within the borough of Croydon or within four miles of the existing Addington pumping-station of the Croydon Corporation. This provision also was inserted by agreement. In 1904, the Wolverhampton Corporation obtained protection under the Act of the Oakengates and Dawley Joint Water Board; and the Board were prohibited from sinking wells east of a certain line. This provision likewise was inserted by agreement. In the Mansfield Corporation Act, 1905, the Worksop Urban District Council obtained a clause, which was inserted by Parliament, whereby the Corporation were prevented from sinking wells within 1¾ miles of the Council's well. In the Borough of Portsmouth Water Act, 1906, the Gosport Water Company obtained a clause prohibiting the Portsmouth Company from abstracting water west of a certain line; and the Gosport Company were put under a similar restriction east of the same line. These prohibitions will have the effect of preventing these two Companies from sinking wells within two miles of one another. This provision was inserted by agreement.

In the meantime, the claim of landowners (other than water companies) to have their water supply protected had been admitted. A very wide clause for this purpose is to be found in the Goole Urban District Council Act of 1899. In that Act it is provided (section 21) that if the supply of any water to any lands, houses, or premises within certain parishes from any existing wells, pumps, ponds, or watering-places, is diminished or prejudicially affected by the exercise of the powers conferred by the Act, the Urban District Council shall then either supply compensation water free or shall pay a money compensation. This provision was inserted under strong pressure from the Committee of the House of Lords. A similar clause occurs in the Selby Urban District Council Act, 1904. A somewhat similar provision was inserted in the Oakengates and Dawley Joint Water Board Act, 1904, for the protection of certain large landowners; the Board being bound to make good, by a free supply, any deficiency of water that might be caused by their operations in the wells, ponds, or pools of the landowners within two miles of the wells of the Board. This provision was inserted by agreement.

In the case of the Bedford Corporation Water Act, 1902, Trinity College, Cambridge, which owned two wells that might possibly be affected, obtained a provision that, if the supply of water in these two wells was diminished in consequence of the carrying out of the works under the Act, the Corporation were to supply free water to make up the deficit; the College paying 4 per cent. on the pipe outlay. This provision was opposed by the promoters. In the Gosport Water Act, 1904, section 8 provides that if, by reason of pumping at the Company's Soberton well, any existing well within a radius of 1½ miles, or the River Meon within that radius, shall be depleted or diminished, the Company shall afford compensation water at the rate at which the owner formerly got his full supply, or shall pay compensation. This provision was inserted by Parliament.

In all these cases, it will be observed that Parliament has afforded protection against the danger of a decrease of supply of water in consequence of the exercise of the powers it was then conferring.

It now remains to deal with an interesting case of a different character, which may form a far-reaching precedent. From its proximity to London and the densely populated suburbs, and from the fact that its underground sources of supply are peculiarly assailable, the River Wandle seems destined to be the *corpus vile* upon which experiments towards the development of water law are made. The water composing it is collected in the chalk over a large area to the south of Croydon, the highest point of which is the head of the Caterham Valley. The rain water soaking into the ground reaches the chalk. A general movement then takes place in a north-westerly direction; the water collecting in, and moving along, fissures in ever-increasing volume, until at Carshalton (and in a lesser degree at Croydon) the level of the surface of the ground has fallen sufficiently to allow these underground streams to emerge, which they do in a number of springs of considerable volume. The River Wandle then flows (without receiving any tributaries) to the Thames, being in its short course very extensively used for power. In addition to this, the chalky water has peculiar properties which are valuable in the preparation of hides and in the dyeing of stuffs. Any diminution of its volume therefore rouses the most violent opposition. As has been said, the House of Lords determined in *Chasemore v. Richards* that the tapping of its underground supplies gave those who made use of the river no remedy at law.

The struggle which ended in the passing of the Sutton District Water-Works Act, 1906, and which involved the fate of the River Wandle, started in the first instance between the Sutton District Water Company and the London, Brighton, and South Coast Railway Company. The Water Company own a well sunk in the chalk at Sutton; and the Railway Company own a field alongside their railway about half-a-mile from the well. In this field the Railway Company sank a 2-foot boring to a depth of 350 feet, and erected a powerful pump, with the intention of conveying the water they obtained along their line and using it. This boring was within half-a-mile of the Carshalton springs of the Wandle, and so those interested in the river asserted that it was directly in the line of flow of the underground water running to the springs.

It has already been pointed out that the injury an ordinary landowner can inflict upon his neighbours by exercising his rights to extract all the water he can get, is usually limited by the fact that he can only dispose of a certain quantity. Without the consent of other people, he can take it no farther than the confines of his own estate. It has also been pointed out that water companies are endowed by Parliament with continuous lines of pipes along which they can remove and distribute large quantities of water, and that from this fact springs their peculiar power to inflict injury. Now, a railway company has also been endowed by Parliament with a property utterly exceptional in character (no other landowner possesses a strip of land hundreds of miles long by a few yards broad), which can incidentally be used for the distribution of water. Although the company cannot, of course, sell any water they obtain, yet the use they can themselves make of it up and down their line for stations, hotels, carriage-washing, and other purposes, is of a degree entirely different from that of any other owner except established water companies. Although the use of the railway lines for such a purpose was, no doubt, never contemplated by Parliament when the railway company was created, yet there does not appear to be anything illegal about it.

To return now to the boring of the London, Brighton, and South Coast Railway at Carshalton. The Sutton Water Company were alarmed at the proximity of this boring to their wells, and feared that the extensive use that would no doubt be made of the water obtainable would affect their own supply. They were advised that nothing illegal was being done or proposed by the Company. They therefore made common cause with the local authorities and other persons interested, and, in particular, with the owners and occupiers of properties on the River Wandle, and promoted a Bill in Parliament, as a last resort, prohibiting any person (without the express authority of Parliament) from conveying water taken from any well or watercourse within the area of supply of the Water Company for sale or use outside that area. The Bill, though in form of general application, was avowedly aimed at the Railway Company. The operative clause was as follows:—

> 3.—From and after the passing of this Act, it shall not be lawful for any company, body, or person, except with the express authority of Parliament hereafter obtained, to convey by pipe or conduit, for sale or use beyond the area of supply, water taken from any well or watercourse within such area: Provided that nothing in this section contained shall take away—
>
> (1) Any right of any landowner (other than a railway company) to supply with water any part of his estate situate within, or partly within and partly without, the area of supply, or to construct works for that purpose; or
>
> (2) Any right of any railway company to supply with water any station or stations within the area of supply, or to construct works for that purpose, or to use on any engine or carriage, without as well as within such area, water supplied at any such station or stations.

As a preliminary measure, a Bill which the Railway Company were then promoting (and which did not deal with this scheme) was opposed in the House of Commons on second reading, on

the ground that the Company were making an oppressive use of their position. In the debate that followed, the Secretary for the Board of Trade said that for a Railway Company to take water at Carshalton and bring it to London was, in the opinion of the Board, an enlargement of their powers for which they should not press. It was constituting themselves a *quasi* water company. He had represented this to the Railway Company, who had undertaken to restrict the use of the water to places within six miles of the well. On this he thought the Company's Bill might pass its second reading, which it accordingly did. As this area included large carriage-washing sidings at Streatham, nearly six miles off, and 43 stations, the promotion of the Sutton District Water Bill was continued.

The whole strength of the case for such an unprecedented measure depended upon its being possible to show that extensive pumping at a well located where the boring of the Railway Company was would, in fact, seriously affect the River Wandle and the well of the Water Company. The contention of the Railway Company was that, as they would pump from a depth of 350 feet from the surface, they would draw upon an inexhaustible supply of water in the deep chalk, without affecting in any way the surface springs or the comparatively shallow wells.

It seemed that Parliament would be confronted by the difficulty of choosing between the different opinions of two perfectly honest bodies of scientific witnesses. A conclusive piece of evidence was, however, unexpectedly forthcoming. The boring having been completed, a three days' test of its yield by continuous pumping was carried out. One of the smaller of the Carshalton springs issues from the ground in a convent garden, between 700 and 800 yards from the boring, and is led in a 2-inch pipe to a well from which the private water supply of the convent is pumped. Upon this pipe a recording meter was fixed. The test lasted three days, during which about 2 million gallons of water were raised from the boring. The discharge of the convent spring fell from 700 gallons to 400 gallons an hour, and rose again when the pumping ceased. More conclusive proof of the effect of pumping from a deep well has probably never been laid before a Committee of Parliament or any other tribunal. During the period of pumping, the lake in the convent grounds, which is fed by other springs, fell about a foot, and rose again in the same way. The above, and measurements of other springs of a less exact character, accounted for more than half the quantity of water pumped. No further demonstration was required of the fact that pumping at the borehole must deplete the river; and presumably the Water Company's well would also be affected. The Bill was passed by both Houses of Parliament and became law. As a consequence, the Railway Company's well was abandoned.

In this case, Parliament went a long way towards laying down the principle that, while practically no restriction is placed by the law upon the use of underground water by an ordinary landowner, the use of this water by a body created with peculiar facilities for taking away large quantities comes under a different category, and in such a case the other persons in the locality require protection—whether, as in this case, by limiting the operations of the body in question, or, as in the case of bodies whose object is the abstraction of water, by granting compensation to persons affected. The authors submit that this is the right principle. The measure of compensation would, no doubt, be less in cases where the consumers would themselves have had the right to take the water. The onus would, of course, be on the persons injured to show that their injury was the result of the operations of the water company or similar body; and it would probably only be in cases of real hardship that this could be proved. But the right to attempt to do so should not, it is submitted, depend upon the chance opposition, at great expense, to a Bill before a Committee of Parliament, but should be a right assured to every person who may be affected, before the Bill created the water-abstracting body is passed. Whether this right would be best secured by an amendment of the Water-Works Clauses Act or by some other means, the time has not yet come even to suggest. It is enough for the moment to get the wrong acknowledged.

An American Gas Information Bureau.

In connection with the American Gas Institute, there has been formed a "Bureau of Information," to which the members may apply, through the Secretary, for assistance. It is composed of Mr. W. H. Gartley, who will take the subject of gas manufacture and the control of works; Mr. R. B. Brown, who will furnish information on construction; Mr. J. D. von Maur and Mr. H. L. Rice will deal with ordinary and high-pressure distribution; Mr. F. W. Frueauff will undertake commercial subjects; and Mr. E. H. Earnshaw will advise on residuals and chemistry. The Bureau will not attempt to do the work of a consulting gas engineer, and will rather endeavour to indicate methods of solving problems submitted than do this themselves. Where satisfactory answers already exist to questions asked, the questioner will be directed to them; and where they cannot be answered positively, he will be informed to this effect. Where the matter is plainly one for the consulting gas engineer, the questioner will be advised to employ one. All questions and answers that may be deemed of value to the membership in general will be recommended to the Directors of the Institute for publication in the "Proceedings."

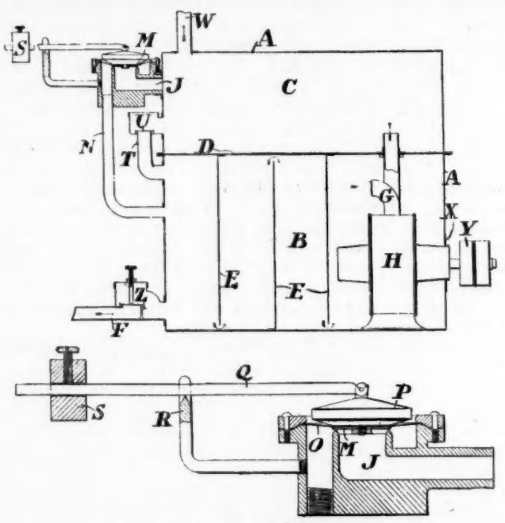
REGISTER OF PATENTS.

Gas-Compressing Plant.

ROESSLER, A. C., and the AIR LIGHT COMPANY, LIMITED, of Victoria Street, S.W.

No. 12,945; June 2, 1906.

This plant for intensified gas lighting is said to obviate some objections felt to some other processes, when at times "considerable difficulties have arisen on account of the inconvenience caused to neighbouring consumers at times when a variation in the load occurred." Thus (the patentees remark) take the case of a plant adapted to supply 100 lights at maximum load, and assume that the load is changed from 25 lights to 75 lights. There is a sudden increased demand, to meet which increased demand the compressor is usually driven at a higher speed. This efficiently meets the requirements of the user of the compressed air circuit; but it causes serious inconvenience to neighbouring consumers, and may extinguish their lights.



Roessler's Gas-Compression Plant.

The apparatus to be described comprises an arrangement of pump, suction and pressure chambers, and relief valve, which is said to "avoid all the difficulties" "without introducing complications."

According to the construction shown, the suction space or gas-reservoir is disposed in the lower part B of a tank, the upper part C of which is partitioned off by a plate D, and forms the compressed-gas reservoir. The suction—*i.e.*, the lower—space B is preferably provided with cross-baffles E, which cause the gas to follow a zig-zag path from the low-pressure gas inlet F of the suction space to the inlet G of the compressor H. Arranged within the suction space is the pump H, which compresses the gas into the upper compressed-gas reservoir C. By placing this compressing device H within the suction space B, it is not necessary to provide the casing of the compressor pump with perfectly gas-tight joints. Also the space occupied by the apparatus is considerably less than in compressors where the pump is placed outside the gas-tank. Leading from the compressed-gas reservoir C there is a pipe J, controlled by a balanced relief-valve, so arranged that when too high a pressure occurs in the upper reservoir the valve M is raised from its seat and gas flows past the valve M, through a pipe N leading into the suction space B.

The construction of balanced relief valve employed is shown larger. A diaphragm O is loosely fixed over the overflow outlet J from the compressed-gas reservoir C. To the diaphragm there is fixed a weight P, which, under normal conditions, presses the diaphragm against the overflow outlet, and thus prevents egress of fluid from the compressed-gas reservoir. The weight is supported by one end of a lever Q, which is pivoted on a knife edge R, and carries an adjustable weight S on the side of the knife edge remote from the diaphragm weight. By adjusting the position of the weight, the pressure at which the relief valve is opened may be varied. A convenient pressure for intensified lighting is said to be 56 inches of water column.

In order to enable the ordinary low-pressure lighting to automatically come into operation when the compressor is stopped, a bye-pass connection T is provided between the suction space and the upper compressed-gas reservoir. This connection is provided with a light non-return valve U, arranged to open inwards with respect to the chamber C. Thus, when the compressor is stopped, the pressure in the upper reservoir will rapidly fall. The ordinary gas pressure (say, 15-10ths) is then sufficient to raise the non-return valve, and permit the flow of ordinary low-pressure gas from the lower into the upper compartment of the tank. From this upper compartment a pipe W leads to the burners.

The compressor is of the rotary type, and driven by a direct-coupled electric-motor or by a pulley and belt; the shaft of the compressor passing through the side of the tank at X, and carrying the usual fast-and-loose driving pulleys Y.

In order to prevent a back flow of gas into the ordinary mains (with which the pipe F connects) when the balanced relief valve M is brought into operation by an over-pressure in the upper compartment C, a non-return valve Z, provided with an adjusting stop screw for limiting its opening, is placed on the ordinary low-pressure gas inlet F to the compartment B.

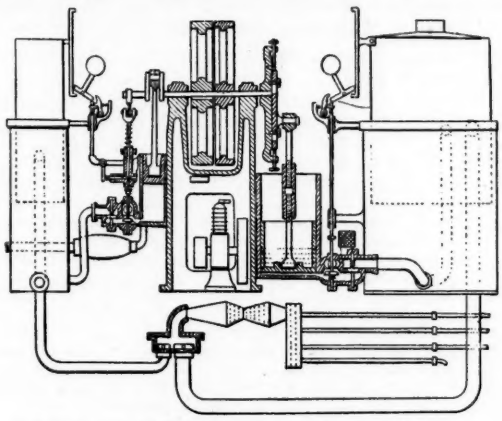
Mixing, Measuring, and Carburetting Gaseous Bodies.

Bouvier, A., and Collon, E., of Paris.

No. 21,022; Sept. 21, 1906. Date claimed under International Convention, Sept. 30, 1905.

This invention relates to an apparatus capable of supplying two or more currents of gaseous fluids at a strictly constant predetermined pressure (the volumes of the different gases delivered being in a predetermined proportion) and which allows of mixtures of different gases or vapours of volatile liquids to be obtained in a given proportion or description. The apparatus has been designed to produce—principally for lighting or for intense heating by means of gas—a given combustible mixture of gas and air delivered at the time it is used under constant pressure; "the air and the gas being mixed in a proportion which can be regulated at will, but which remains constant after being regulated."

This result is said to be obtained by means of two pumps connected together as shown, and giving the necessary deliveries for the final mixture, and each delivering its fluid into a special reservoir at constant pressure—either, for example, in a gasholder of constant weight, or into a closed stationary air-tight reservoir of constant volume.



Bouvier and Collon's Proportionate Gas and Air Mixer.

The amount of the two fluids delivered is simultaneously regulated by two independent arrangements, operated by the extreme positions of the gasholders or by the maximum pressures in the stationary reservoirs acting on the inlet valves of the pumps in such a way that the two fluids are delivered at the outlet either of the gasholders or of the stationary reservoirs, under a certain predetermined constant pressure, identical for the two liquids. Thus the two fluids leave in proportional quantities, and under the same pressure, and pass into a mixer, and from there to the burners. It is possible, however, to modify the proportions of the mixture in a permanent way to a certain extent for any given apparatus. Moreover, the mixer has an arrangement which renders it possible to, if need be, correct the proportion of the two fluids—that is to say, the strength of the mixture. From there the two fluids, now mixed in a single stream, pass through a pipe consisting of cones connected together suitably arranged and open and at an angle of about 7°, and provided wih metal gauze or other suitable arrangements ending in pipes of small diameter, which conduct the mixture to the different burners. There the mixture is burnt, either in a blue or a white flame. From the nature of the apparatus it is possible to have an oxidizing, a neutral, or a reducing flame, and to keep it constant and unchanged—thus "causing it to approach as nearly as possible to the maximum thermal efficiency."

The illustration is a general view (partly in section) of one form of apparatus with a rising and falling gasholder. The specification, however, contains another view of apparatus with reservoirs having a constant volume. The arrangement is not, however, further described by the patentees apart from the closely lettered drawings.

Testing Gas for Carbon Dioxide.

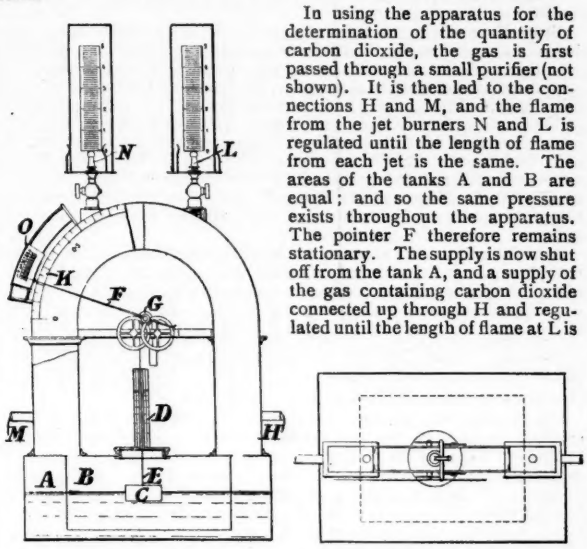
Tervet, W. P., of Plymouth.

No. 15,013; July 2, 1906.

This apparatus, for ascertaining the percentage of carbon dioxide in illuminating gas by a direct reading, is similar to the ordinary jet photometer, which "consists of an apparatus for measuring the pressure required to give a flame of a given length through an orifice of known size."

An outer tank A contains an inner one B, which is without any bottom. The liquid in the two tanks is therefore common to both. In the inner tank is a float C, and above it a sealing arrangement D, which is connected to the float with a rigid wire E. The cap of the sealing arrangement is connected to a pulley G, on the shaft of which is fixed a long pointer F. When the gas is brought to the outer tank through the pipe H, the pressure acting upon the water in A causes that in the inner tank to rise, carrying with it the float. The rising of the float causes the pulley to partially revolve, and with it the pointer; thus indicating on the scale K the amount of pressure put upon the water of the outer tank. The gas which enters the outer tank is also connected to a jet burner L on the top of the apparatus, where it can be burned and the length of the flame measured. The inner tank is also connected at M to a gas supply carried to another jet burner, also on the top of the apparatus, where it can be burned at N, and the length of the flame measured.

As the quality of the gas varies, so will the pressure necessary to maintain the length of flame also vary; so that the zero point of the carbon dioxide scale will vary. A sliding adjustable scale is therefore so fixed that the zero can be shifted according to the quality of the gas under test, as the patentee finds that "the deflection of the pointer from such zero is constant, despite fluctuations in the illuminating power of the gas." He says he is "aware that the sealing arrangement upsets the equality of the gas pressure areas in the apparatus; but as this is a constant variation, it does not affect the ultimate graduation of the scale."



Tervet's Carbon Dioxide Test.

In using the apparatus for the determination of the quantity of carbon dioxide, the gas is first passed through a small purifier (not shown). It is then led to the connections H and M, and the flame from the jet burners N and L is regulated until the length of flame from each jet is the same. The areas of the tanks A and B are equal; and so the same pressure exists throughout the apparatus. The pointer F therefore remains stationary. The supply is now shut off from the tank A, and a supply of the gas containing carbon dioxide connected up through H and regulated until the length of flame at L is the same as that of the other supply from the carbon dioxide freed gas at N. As a greater pressure will be required on the supply at H owing to the gas containing carbon dioxide, the equilibrium of pressures will be upset, and the position of the float C, and with it the pointer F, will be altered—the new position of the pointer F corresponding to the percentage of carbon dioxide present. By making a series of tests with gases containing a known percentage of carbonic acid or carbon dioxide, a scale O can be formed, and thereafter the percentage of carbon dioxide can be obtained by a direct reading according to the position of the pointer—such scale being made sliding and adjustable so that the zero point can be adjusted according to the quality of the gas under test.

APPLICATIONS FOR LETTERS PATENT.

11,091.—Robert Dempster and Sons, Ltd., and Horsfall, J. E., "Controlling and directing the flow of gas through condensers, purifiers, scrubbers, and the like." May 13.

11,097.—Pye, T. E., "Distillation of gas coals." May 13.

11,124.—Leisenring, H. G., "Acetylene generators." May 13.

11,133.—Lumb, J., "Gas-engines." May 13.

11,169.—Holman, S., "Carburettors." May 13.

11,184.—Howorth, F. W., "Transport and storage of mantles." A communication from Deutsche Gasglühlicht Aktiengesellschaft (Auergesellschaft). May 13.

11,206.—Denham, W., "Suction gas plants." May 14.

11,240.—Glasscoe, T. H., "Carburetted air-gas apparatus." May 14.

11,301.—Gaudin, A., and Tellier, E., "Igniting burners." May 14.

11,324.—Main, R. B. & A. P., "Gas-fires." May 15.

11,379.—Hansford, J., "Controlling the supply of gas." May 15.

11,465.—Tibbits, C. W., "Gas-generator." May 16.

11,474.—Keith, J. & G., "Gas and air compressors." May 16.

11,573.—Hill, H., and Hacking, A. E., "Gas-valves." May 17.

11,574.—Barnes, F. V., "Automatic gas-lighter." May 17.

11,579.—Mackey, W. M'D., "Treating spent ammonia liquor." May 17.

11,650.—Brodie, G. G., and Coleman, A. B., "Gas stoves and ranges." May 18.

Abstraction of Water from the Thames.—At the meeting of the Thames Conservancy Board before Whitsuntide, a letter was received from Mr. A. B. Pilling, the Clerk to the Metropolitan Water Board, relating to the abstraction of water from the Thames in connection with the Board's Various Powers Bill. He stated that the Law and Parliamentary Committee had been given full powers by the Board in regard to this matter; and, in view of the urgency of the case, the Clerk suggested whether it would not be convenient to endow the Parliamentary Committee of the Conservancy with similar powers, in order that effect might be given without delay to any basis of agreement which might be arrived at. Mr. C. Burt, the Chairman of the Parliamentary Committee, moved a resolution authorizing the Committee to agree to terms for the unification of the existing arrangements. Some discussion followed; several members being of opinion that the power should not be granted to the Committee, the Water Board having everything to gain and nothing to lose, while the Conservancy had everything to lose and nothing to gain. Sir John M'Dougall moved, as an amendment, that the following words should be added: "That no increased quantity of water should be taken from the River Thames during the summer months." In the course of further discussion, it was pointed out that the matter was urgent, that both bodies would safeguard the interests of the public, and that the necessary power should be given to the Committee. Eventually Mr. Burt's motion was adopted.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Early Gas Literature and the Gas Institution Library.

SIR,—Your readers, one and all, I am sure, must have been greatly interested in "The Earliest Works on Gas Lighting," the titles of which you published in your last issue. I should like to express my warm thanks and appreciation to Mr. F. Southwell Cripps for his admirable compilation, which is not the first that he has made and placed at the disposal of students of gas history. I do so all the more heartily because, in a less detailed and rather different way, I endeavoured to do something of the kind in my "Classified List of British Gas Engineering Literature," in an appendix to my book on "British Progress in Gas-Works Plant and Machinery." Investigations into early gas history undoubtedly have an educational, as well as an antiquarian, value.

Out of the 68 (or so) publications listed by Mr. Cripps, it is rather notable that only six are stated to be found in the library of the Institution of Gas Engineers. I think, however, that I am right in saying that at least two more ought to be added to the six; for the 1902 list of books in the library of the Incorporated Gas Institute includes Peckston's "Theory and Practice of Gas Lighting" (1819, First Edition), and Matthews' "Compendium of Gas Lighting" (1832, Second Edition). But it must be regretfully admitted that the library of the Gas Institution is, as Mr. Cripps says, "far from complete."

I have often thought that more importance might be given to, and more use made of, the books in the collection of the representative Gas Institution. One of the clauses in the Memorandum of Association of that body is: "(*j*) To establish, form, and maintain a library and collection of models, designs, drawings, plans, and other articles of interest in connection with the manufacture and application of gas." What has been done in this direction, I ask, apart from the acceptance of the ordinary yearly presentations to the library? Opportunities have recently occurred of purchasing historical works relating to the gas industry, and of enriching gas libraries; and I trust that the Institution of Gas Engineers is not backward in profiting by such occasions as and when they occur.

For my part, I confess that I should like to see a Librarian, honorary or otherwise, as one of the officials of the Institution. He would certainly have plenty to do; for I believe there is not at present even a complete printed catalogue of books in the library. Subject-matter indexing would also be a most useful adjunct to the Librarian's work. Further, all books should be freely in circulation, under certain conditions, and available upon demand by any member, country or town, of the Institution. In some such way, it seems to me, the utility of the Victoria Street library could be increased; and the Institution itself become even a more continuous centre for affording technical guidance and disseminating information.

I should not like it, Sir, to be thought that in these more or less haphazard observations I was casting in any way any reflection upon the authorities of the Institution of Gas Engineers. I am merely desirous, as a one-time civil and gas engineer, and as a present student of early gas history, of seeing as complete, embracive, and useful a gas library as possible, built up and used by members of the Institution of Gas Engineers.

Temple, E.C., May 25, 1907. C. E. BRACKENBURY.

Effect on Meat of Cooking by Gas.

SIR,—The perusal of the extract from the "Lancet," under the heading "Effect on Meat of Cooking by Gas," in your issue of Feb. 12 last, has been perused with interest, but the effect produced is that of confusion. The writer refers to the exposure of the meat to small quantities of such "incomplete products of combustion as carbon monoxide, acetylene, and sulphurous acid, and the complete products carbon dioxide, steam, and traces of sulphuric acid." Then, further, he speaks of a chamber containing gas-flames inside, and the greater advantage of roasting meat by what is called "open roasting," as compared with the gas-oven; and he gives the impression that he experimented with illuminating burners.

I suppose the number of houses in any county in England at the present time where open roasting is carried on by means of the jack placed in the flue of the chimney, or the bottle jack, could be counted on one's fingers. At all events, if the writer were in the Colony from which I am writing, and attempted such a process with the labour available here, he (or she) would find that no outside help could be obtained for a second operation. I well remember the heat of such fires in my younger days. So one may fairly say that roasting meat by open roasting in front of the fire is to-day impracticable.

Then the writer discounts gas-ranges by stating that, in open roasting, ascending heat currents form a very important feature; and he seems to imply that ascending heat currents are absent in gas-ranges. I cannot enter into the question of the inferences to be drawn from "traces of sulphuric acid." I have always been under the impression that sulphuric acid, if ever deposited by the combustion of coal gas, resulted from some change subsequent to, and not from, combustion.

It occurs to me that the article could well be severely criticized in the interest of younger members of the staffs of gas companies. It is a long time since the late Mr. Hartley gave us the result of his experiments. Such criticisms would be of interest to those who have joined the ranks in later years in Great Britain and also to us under the

The Antipodes, April 8, 1907. SOUTHERN CROSS.

The Darlington Water Committee have decided to increase the efficiency of the machinery at their pumping-station on the River Tees at Low Coniscliffe; and a contract has been placed with the National Gas-Engine Company for an 80-H.P. suction-gas plant, which is intended to replace a steam-driven pumping-engine.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF COMMONS.

The following further progress has been made with Bills:—

Lords Bill read a second time and committed: Tees Valley Water (Consolidation) Bill.

Bill read the third time and passed: Leeds Corporation Bill.

The Great Yarmouth Corporation have petitioned against the Great Yarmouth Water-Works and Lowestoft Water and Gas Bill [Lords], and the Great Yarmouth Port and Haven Commissioners against alterations in the Bill. The Tynemouth Corporation Water Bill is to be opposed by the Tynemouth Rural District Council. The Company bearing the title of Selsey-on-Sea Limited, have petitioned against the Selsey Water Bill [Lords].

METROPOLITAN WATER BOARD (CHARGES, &c.) BILL.

(*Before Viscount* CROSS, *Chairman, the Marquis of* WINCHESTER, *Earl* MANVERS, *Lord* ABERDARE, *Viscount* RIDLEY, *Sir* J. RANDLES, *Mr.* ROSE, *Mr.* WHITBREAD, *Mr.* DUNCAN, *and Mr.* LUKE WHITE.)

The Committee proceeded on the 13th inst. with the consideration of the Bill (*ante*, p. 464).

The Hon. J. D. FITZGERALD, K.C., Mr. HONORATUS LLOYD, K.C., Mr. COURTHOPE MUNROE, and the Hon. E. CHARTERIS were Counsel for the Bill, against which there were a large number of petitioners.

Mr. *F. E. Harris*, the Comptroller to the Board, cross-examined by Mr. WEDDERBURN, K.C., representing the Committee of the Associated Manufacturers and the London Chamber of Commerce, said that since 1898 there had been an average increase in the rateable value of Outer London of £623,000; but it was quite possible for expenditure on pensions and in other directions to neutralize the effect of increase in income. About half the present trade supply was at 6d. per 1000 gallons, and this rate obtained in the areas of five of the Companies. The average cost of meter supply and domestic supply came to about 8d. per 1000 gallons; but it was not possible to say how an individual supply might work out. With the exception of a small quantity of water derived from the springs at Hampstead and Highgate, all was filtered, and it was not possible to differentiate between water for machinery boilers and that used for domestic purposes.

Witness was also cross-examined on behalf of City owners and wharfingers; the Ecclesiastical Commissioners, in respect to their property at Paddington; the Master Builders' Association; and the Islington Borough Council.

In re-examination, witness said it was not the case that the Board proposed to double the rate for trade purposes; the maximum rate would be 1s. The existing maximum varied from 9d. to 7½d. per 1000 gallons, *plus* high-service charges; and in many of the cases with these charges the maximum in the Bill would be nearly reached.

Mr. *W. B. Bryan*, the Chief Engineer to the Board, was called at the request of Mr. WEDDERBURN, and, in reply to questions, said that he was formerly the Engineer to the East London Water Company. The price charged by the Company for water for trade purposes was 6d. per 1000 gallons—the maximum being 9d., with 25 per cent. for high service.

This closed the case for the Bill.

Mr. WEDDERBURN, in opening the case for the Committee of Associated Manufacturers, said the Bill signally failed, because it went far beyond the mandate to the Board contained in the Act of 1902. There was no mandate to create a deficit and throw the burden on one class of consumers. Why should commercial London pay for cheapening the cost of water to domestic London? The 1s. maximum with no graduated scale would create in commercial London the greatest insecurity. To meet the position, he submitted a plan approved by the traders and the Chamber of Commerce for a supply on a graduated scale and by meter to traders. The scale proposed started with a 5 per cent. charge on premises under £30, graduated through five other classes—viz., £31 to £50, 6 per cent.; £51 to £200, 5½ per cent.; £201 to £300, 4½ per cent.; £301 to £1000, 4 per cent.; and above £1000, 3½ per cent. The scale suggested for trade supplies was according to the quarterly consumption per 1000 gallons: Up to 50, 9d.; 50 to 100, 8d.; 100 to 200, 7d.; over 200,000, 6d., with 25 per cent. additional in each class for high service. Public supplies should be at the rate of 7d. per 1000 gallons. Meter-rents should be charged, according to size of meter, from 2s. to 25s. per quarter.

Evidence to support the foregoing proposals having been given,

Mr. *G. R. Strachan*, speaking from long experience of water undertakings, said he was satisfied that water for trade purposes could be profitably supplied at 6d. per 1000 gallons.

Mr. *W. B. Keen*, a Chartered Accountant, gave evidence in support of the scale of charges submitted by the traders, and explained tables upon which he showed that the financial effect would be an estimated deficiency of only £104 on the gross revenue of the Board for the year 1905.

Mr. *J. Bidgood*, a member of the Middlesex County Council, expressed the feeling of the Council that the adoption of the uniform scale of 5 per cent. would operate severely to the prejudice of the districts formerly served by the Grand Junction and West Middlesex Water Companies. He said the general effect of the proposal would be to relieve the water-rate in Kent, Surrey, and Essex at the expense of consumers in London and Middlesex.

Evidence was also given by Mr. *G. E. Eachus*, the Engineer and Surveyor, and Mr. *W. F. Payne*, the Clerk to the Edmonton Urban District Council, as well as by a number of witnesses from Tottenham, Wood Green, Willesden, and Hanwell; the general effect being to show that the uniform rate of 5 per cent. would tell hardly against the large proportion of the occupiers of houses in those districts rated at £30 and under.

Sir R. LITTLER, K.C., in presenting the case for the City of London against the Bill, said the Corporation acted in response to a special

request of ratepayers conveyed through a resolution passed at a public meeting held on the 6th of March, protesting against the measure. He said that in the City the charge for water was enormously in excess of that made elsewhere; while the consumption in proportion to the rateable value of the premises supplied must be very much less. The absence of provisions for dealing with unoccupied houses and for shops, warehouses, and offices was a serious blot on the Bill. He strongly objected to the absolute discretion proposed for the Board to make or refuse agreements, and protested against traders having to go cap in hand to beg fair treatment for special cases.

Mr. FITZGERALD, answering a question put by the Chairman, explained that the actual rebate of 30 per cent. allowed on City property amounted to £33,000 a year; but if the full 5 per cent. were levied on the full annual value, the present charges would be increased by about £99,000.

Sir *Felix Schuster*, the Governor of the Union of London and Smiths Bank, gave details of the ratings of bank premises in the City. He said the amount paid by his bank for water was £937 a year, which represented 2½ per cent. on the rateable value, under arrangements made with the New River Company and continued by the Board. If the charge were raised to 5 per cent., the payment would be equal to £3 5s. per person employed in the bank business. He said the levy of the rate proposed, without rebate, would mean a charge of 22s. per 1000 gallons. He advocated a supply to the City by meter.

Alderman Sir *T. Vesey Strong*, a member of the Metropolitan Water Board, expressed the opinion that the Bill would burden those who already paid more than sufficient for the water consumed.

Mr. *Samuel Wood*, of the firm of Messrs. Wood, Drew, and Co., Chartered Accountants, said he had examined the tables put in by the promoters, and found from the income that the charge for the whole area worked out at 8d. per 1000 gallons; but in the City it came out at 10d. He put in a table showing the effect of the Board's proposal on a number of business premises of which the rateable value was over £70,000. He said that at present these premises paid £18,000; but under the Bill they would have to pay more than £36,000.

Mr. *Herbert Fuller* said he had made an estimate of the quantity of water supplied to the City of London, based on the population as given in the Medical Officer's report. He reckoned that 1970 million gallons were used, of which 798 millions were for domestic service, and cost £117,649, or at the rate of 35·37d. per 1000 gallons; and 1172 millions for trade, and cost £39,205, or 8·02d. per 1000 gallons.

Sir *Alexander Binnie* said it was usual throughout the whole of England for a distinction to be made in the rate of charge for water used on residential or non-residential premises.

The case for the owners of City properties was then gone into.

Mr. *Walker*, the Secretary of the City of London Real Property Company, said their properties had a total rateable value of £127,000, and they paid £2350; but under the Bill they might have to pay £6363. He put in a number of tables which showed that the City consumer at present paid 11½ times the price for water a domestic consumer outside the City paid; and under the Bill he would have to pay 27 times as much.

Mr. *C. E. Corbett*, M.P., the Chairman of the Associated Owners of City Properties, gave evidence as to the effect the proposals of the Bill would have on property managed by himself.

Mr. *Stanley Machin*, the Deputy-Chairman of the Council of the Chamber of Commerce, said the Chamber thought the price for trade purposes should be reduced rather than increased. They objected to any discretionary power being given to the Board in regard to the price of the water used for trade purposes.

Mr. *W. Martin*, the Comptroller of Estates to the Prudential Assurance Company, said they at present paid £688 a year for water; but if the Bill were passed the charge would be £1367. Under the scale proposed by the Chamber of Commerce, they would only have to pay £35 increase on the present rate. If the Bill were passed, they would in all probability sink an artesian well on their property.

Mr. BLENNERHASSETT, K.C., then opened the case for the Westminster City Council. He submitted that the Bill proposed an inequitable shifting of the burden from one set of ratepayers to another; and he urged the Committee to reject it.

Mr. *P. E. Pilditch*, the Chairman of the Law and Parliamentary Committee of the Council, said the proposals of the promoters would mean an increased charge to Westminster of £52,504—a larger sum than any other district would be called upon to pay.

Mr. *Lister Woodhouse*, the Comptroller to the Council, said that under the Bill the cost of water per head would be £1 3s. 2¾d. in Westminster, and in the outside area 3s. 7d.; for the County of London it would be 6s. 4d.; and for the total area 5s. 6d. He argued in favour of an additional charge of 1 per cent. on properties outside London, and contended that if a 30 per cent. rebate was to be given to the City of London, it should also be given to Westminster.

Mr. RAM, K.C., addressed the Committee on behalf of the Bishop of London's estate at Paddington, which formerly belonged to the See of London, but is now in the hands of the Ecclesiastical Commissioners. This estate has for many years been entitled to a reduction of 10 per cent. on the charges made for water for domestic purposes. He argued that under the Act of 1902 the Board had to take over the Water Companies and all their liabilities, and included in them was this particular liability, which represents £4700 a year, which sum had to be capitalized in fixing the price the Board had to pay for the undertaking. They now proposed to keep this sum in their pockets, and charge the occupiers of the estate £4700 a year additional. He submitted that this was an act of dishonesty.

Mr. BALFOUR BROWNE, K.C., then addressed the Committee, and described the Bill as being formulated upon the principle of relieving a portion of the domestic consumers at the expense of trade and other sections of consumers.

This closed the opposition to the Bill; and the room was ordered to be cleared. On the re-admission of the public,

The CHAIRMAN said the question of how the occupiers of property in the outside area were to be dealt with was one for the general law, and not for the Committee to decide. They would therefore not trouble Mr. Fitzgerald to answer that part of the case.

Mr. FITZGERALD replied on behalf of the promoters, and justified the imposition of a 5 per cent. rate for domestic purposes. He said that in allowing the 30 per cent. rebate in the City, the Board had continued a practice which had grown up under the New River Company's administration; and to extend it now throughout the whole area would cripple the finances of the Board. If the Committee thought the rebate should be general, the Board suggested that it should not exceed 20 per cent. on properties of £300 value and upwards; and he proposed that the line of distinction between residential and business premises should be the payment of inhabited house duty. To remove apprehensions that the maximum 1s. per 1000 gallons would be exacted for trade supplies, the Board would accede to the demand for a statutory scale from 1s. graduated to 11d., 10d., 9½d., 9d., 8½d., 8d., down to 7d., when the consumption exceeded 5 million gallons quarterly, with the abolition of the high-service charge. In lieu of the clause in the Bill, he would substitute the East London Company's clause providing for a trade supply to any premises near mains or pipes of the Board. To meet the case of temporary supply for builders, he suggested a special clause with a limit of 7s. per cent. on the cost of the contract. The Board could not agree to extend the purposes for which water would be supplied at 6d. per 1000 gallons to public authorities.

The Committee having again consulted in private,

The CHAIRMAN said the Committee had decided that, subject to his following observations, the preamble of the Bill was proved. Any rebate allowed must be general throughout the whole area of supply; but the Board must have power to allow a rebate not exceeding 30 per cent. on houses above the rateable value of £300. This would enable them to give 20 per cent. at once, rising to 30 per cent. by degrees. As to trade supplies, the Committee approved the scale suggested by Mr. Fitzgerald, and the distinction drawn by the payment of inhabited house duty. There must be no condition as to domestic supply in respect of trade supplies—that was to say, traders should not be bound to have a domestic supply first. Public authorities would continue to receive a supply at 6d. per 1000 gallons; but there would be no extension of the purposes for which such supply should be used. The arrangement in respect to the Bishop of London's estate at Paddington should remain undisturbed for 25 years.

The proceedings above reported occupied the Committee till the 16th inst. They then adjourned till the 6th prox., when clauses and amendments to give effect to their decisions will be considered.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Monday, May 13.

(*Before Mr. Justice* SWINFEN EADY.)

Wombwell Urban District Council v. Dearne Valley Water Company.

This was an action to obtain a declaration that, under a certain agreement and an indenture, defendants were bound to supply, and plaintiffs were entitled to receive, all such water as the latter might from time to time require for the supply of their district (such water to be delivered to, and taken by, the plaintiffs in bulk through a meter at 6d. per 1000 gallons); and that the water supplied should be constantly laid on under pressure.

Mr. EVE, K.C., Mr. MACMORRAN, K.C., and Mr. MACKENZIE appeared for the plaintiffs; Mr. ASTBURY, K.C., Mr. ALEXANDER GLEN, K.C., and Mr. JOHNSTON represented the defendants.

Mr. EVE, in opening the case, said the defence was shortly that, under the agreement and indenture referred to, as a matter of construction, the defendants were not bound to supply water under pressure; and, as questions of fact, they alleged that the plaintiffs were unreasonable in requiring a supply of 210,000 gallons of water per day, that the demand was not *bonâ fide*, and that defendants were ready and willing to supply, and had in fact supplied, as much water as could be reasonably required. By way of alternate defence, they alleged, first, that if the quantity of water demanded was reasonable, the fact of the plaintiffs not having obtained it was not due to failure in the supply, but to the inadequate plant provided by them; secondly, that they had sold water for trade purposes, which caused a deficiency in the domestic supply; and, thirdly, that they had not made full use of the other sources of water they had in the neighbourhood under their own control. Counsel said the case was somewhat analogous to that of the Soothill Upper Urban District Council which his Lordship had to deal with some time ago.* In 1872, the Local Board (the predecessors of the plaintiffs) constructed two reservoirs for the purpose of supplying water to the district, which had theretofore depended mainly upon some shallow wells, which were condemned by the Medical Officer of Health. One, called the Jump reservoir, had a capacity of 2,168,449 gallons, and the other, called the Hemingfield reservoir, held 1,171,882 gallons. In the year 1879, certain gentlemen who had contemplated the formation of a Water Company, approached the Board with a view to coming to terms, and avoiding opposition to their proposed Bill; and in the end an agreement was drawn up in March, 1880, between the promoters of the Bill and the Board, and signed. Unfortunately, the original agreement had been mislaid. But in December, 1905, a copy which was agreed upon by both parties was scheduled to an indenture of that date; and on this copy the argument upon construction would now depend. The agreement provided that the Dearne Valley Water Company should not supply consumers within the district of the Local Board, except with their consent; but they might lay pipes in the district. If the Bill passed and the works were carried out, the Company would supply to the Board all such water as they might require, to be delivered in bulk, and paid for at the rate of 6d. per 1000 gallons. The Bill duly passed in August, 1880. For some

* See "JOURNAL," Vol. LXXXVII., p. 670.

time, Mr. John Robinson, the Secretary to the Company, was also Clerk and Water Engineer to the Local Board, and afterwards to the District Council; and while this state of things continued, the agreement worked smoothly, though it was not confirmed by the Company after incorporation, nor by the District Council, who succeeded the Board on Jan. 1, 1895. In July, 1901, an Act was passed confirming certain Provisional Orders, under one of which the Company were bound to keep the water constantly laid on under pressure. This was one of the main points in dispute in the present case, and it depended upon the construction of the agreement. The other questions were those of fact—as to whether the cause of the undoubted deficiency in the water supply in Wombwell was due to shortcomings on the part of the defendants or of the plaintiffs themselves.

Counsel read a good deal of correspondence which had passed between the parties; and then the following evidence was given on behalf of the plaintiffs.

Mr. *E. J. Silcock* said he was consulted by the plaintiffs in September last, and had made numerous visits to the locality. The defendants' sources of supply were wells, the principal one being at Broombill, in the township of Wombwell. Witness described the general nature of the works, and said the pumping-station was at Broomhill, which was nearly the lowest point. The Urban District Council had three reservoirs—the Jump and the Hemingfield (to each of which there was a small natural supply), and a small new one on Roebuck Hill. The maximum quantity flowing into the Hemingfield reservoir was 8000 gallons per day, and into the Jump reservoir 5000 gallons; but for six months there was none. He also described in detail the mains and works of the two parties, and said that if there was no reducing-valve on the 6-inch main, the force would be sufficient to carry the water into the Roebuck Hill reservoir. When he inspected the works, under an order of the Court, on the 6th of April last, he found the first 6-inch reducing-valve open 2 turns out of 12; and the next valve (a 4-inch one), $1\frac{1}{2}$ turns out of 8. Beyond this the pipe bifurcated, with a sluice-valve on each branch; and one of the valves was open a quarter turn out of a total of $7\frac{3}{4}$ turns; and the other $1\frac{1}{4}$ turns out of $7\frac{1}{4}$. The total effect was to very greatly reduce the flow of water. He produced a diagram showing the construction of the sluice-valves, and said those on the plaintiffs' side of the meter were open to their fullest extent. The water went into a tank holding 788 gallons, and from there it was pumped into a 6-inch main going over Roebuck Hill and into the distributing mains. There were two gas-engines, each of 15 H.P., which worked alternatively. The pump, at a low estimate, would raise 20,000 gallons per hour, which was more than ample to pump 210,000 gallons per day. In September and October the Jump reservoir was practically out of use. If the consumption was less than the supply, the surplus went into the Roebuck Hill reservoir. If it exceeded the supply, the reservoir made up the deficiency if it contained water; but if it was empty, the consumers all had to go short. The Roebuck Hill reservoir was at a height of 450 feet above Ordnance datum, which was sufficient to supply the whole district by gravitation, and it held rather less than 100,000 gallons. On the 6th of April, after ascertaining the several facts above mentioned, the valves were fully opened, and then the tank overflowed—more water coming in than the pump could deal with. He had never seen this on previous occasions. On several visits, he had found the Roebuck reservoir empty; and on the same occasions various houses in the neighbourhood had no water. A supply of 210,000 gallons per day was equal to 13·9 gallons per day per head of the population in the district. In designing water-works, from 20 to 25 gallons per head was the quantity usually provided for domestic purposes. Water required for trade purposes would be additional; and 15 gallons per head was a reasonable allowance. He asserted that the quantity of water supplied for trade purposes, in the year ending September last, was 220,000 gallons, equal to 1·07 gallons per head per day—quite a negligible amount.

Cross-examined: He was quite sure there were not 10,000 gallons per day running into the Hemingfield reservoir in the summer, and from 30,000 to 40,000 gallons per day in winter. He gauged it one day in the winter, and found 8000 gallons; he believed that this was in December. He did not make any calculations as to the quantity of water which could pass through the last two valves before the meter in the state in which he found them; he simply took the meter readings, which constituted the best test. The pump was capable of raising 20,000 gallons per hour; but the utmost he ever saw it do was 11,800 gallons. If the tank frequently overflowed when the pump was in full work, it showed that the defendants were supplying more water than this could deal with. He had not calculated the quantity of water which would pass through the valves set as he found them on the 6th of April; it would depend upon the pressure.

Tuesday, May 14.

Mr. *Silcock*, further cross-examined to-day, said the meter readings varied very greatly. On some days the quantity was less than 100,000 gallons. On some occasions there might be special reasons for this—such as repairs to the pumping machinery; but in the main he considered that the readings showed the full amount which the plaintiffs could get, and that the supply was deficient. The valves beyond the outlet of the meter were under the plaintiffs' control. The pressure at the defendants' pumping-station was a head of 600 feet from their Hoyland reservoir. The object of the pressure-reducing valve put in on the 1st of August last year was to lower the pressure; and if the valve remained in the same condition, the changes in the meter readings must depend on the plaintiffs' action. He knew the Jump reservoir was kept empty for several months. Since the 6th of April last, when the valve was replaced in its original condition, the quantity of water taken had been on some days more than 200,000 gallons, and very often it exceeded 180,000 gallons. The Broombill district had a separate supply, and the quantity taken was about 6 gallons per head; it had increased recently. He did not think that a variation of 157,000 gallons in the quantity taken by the plaintiffs on one day ought to disorganize the defendants' operations in supplying their own consumers. As the result of a detailed cross-examination on the daily meter readings, witness adhered to the view that the plaintiffs did not take all the water they wanted, but all they could get, except on special occasions.

Re-examined: The Jump reservoir was not necessary in any way for the supply of the plaintiffs' district. When he first visited the locality in September, 1906, the inlet-valves were fixed in position. The quantity of water passing would depend upon the pressure. The capacity of the Hoyland reservoir was 190,000 gallons. On the occasion of his visit on the 6th of April last, the pump was delivering at the rate of 7000 gallons an hour, which was the highest record he had seen. It was dealing easily with all the water coming in—in fact, it was drawing air about every 8 minutes. This was before the valves were touched. The 6-inch valve (behind the riveted valve) was then fully opened; but he detected no more water coming into the pumping tank; at any rate, it did not make the tank overflow. The same with the next sluice-valve. When the riveted inlet-valves were opened the tank overflowed. It was partially closed to $1\frac{1}{4}$ turns instead of $\frac{1}{4}$ turn as originally fixed, and the engine then pumped at the rate of 11,820 gallons per hour. It would probably have pumped more. He invited the defendants' representatives who were present to take the meter readings with him; but they declined.

By His Lordship: His opinion was that, apart from stoppages of the engine, variations in the quantity of water taken were due to alterations in the pressure, and to the fact that the reducing-valve did not act properly. Such valves were not very reliable; and there was some evidence that this one had been interfered with.

Mr. *W. A. Burton* said he had been assistant to Mr. Robinson, and after he left became Engineer and Manager of plaintiffs' water-works. The water was originally taken from defendants' mains over Roebuck Hill either into the Jump reservoir, or went direct into the mains. The reducing-valve was put in on Aug. 1, 1906, and the effect of this would have been that no water would have been sent either into the reservoir or into the mains the other side of the hill. A 6-inch centrifugal pump was therefore introduced, capable of dealing with 20,000 gallons per hour. The rate depended on the speed of the engine. They had constantly to keep the engine at the lowest possible speed, because the quantity of water coming in was insufficient. It was a 16 H.P. gas-engine; but only 7 H.P. was utilized on the pump. He was present at the inspection on the 6th of April, and could corroborate Mr. Silcock's evidence about it. When the valves were opened sufficiently, the engine pumped at the rate of 12,000 gallons per hour; and this would more than meet the requirements. He produced a table showing the daily working of the engine and the quantities of water pumped. On no day before April last had the quantity reached 200,000 gallons. Since then, however, it had exceeded this amount on several occasions; and there had been no difficulty in dealing with it. Since the reducing-valve was put in, there had been frequent complaints of deficient supply.

Mr. Macmorran here stated that he was in a difficulty about furnishing copies of some of the tables, because the witness's bag, containing a number of documents, some of them original, had been stolen from the Court on the previous day.

Cross-examined: When the demand was made for 210,000 gallons a day, the reservoirs were empty. Since April they had been able to get more than 200,000 gallons, but had not, in fact, used more than they did in 1905. A table was put in showing that in April last, when the supply was so ample that the storage in the Jump reservoir increased by 100,000 gallons a day upwards, the quantity sent into the district was less than 10 gallons per head. There had been a deal of friction between some members of the District Council and the defendant Company. He attended the meetings of the Company and presented a monthly report. At the meeting on April 2, 1906, he drew attention to the deficient supply of water in the higher parts of the district. Their contention was that the defendants were bound to supply the water at constant pressure. Complaint was made to the Local Government Board about the water supply; and the Council replied that at the time of writing the town was amply served. This was in August, 1906. [The letter was read, setting out the Council's case as against the defendant Company.] The Company complained from time to time of the water being turned direct into the mains instead of into the Jump reservoir, as they said it disorganized their service. This was before the reducing-valve was introduced. The practice was continued from time to time without notice, because the Council considered they had a right to do so.

Re-examined: The first of the complaints by the defendants was made on May 2, 1906; and it was in consequence of them he advised the Council to construct the reservoir on Roebuck Hill. If the constant supply under pressure had been continued, there would have been no necessity to provide the pumping apparatus.

Wednesday, May 15.

Dr. *J. N. Millar*, the Medical Officer of Health to the Council, was the first witness this morning. He said he strongly advised the Council to enter into arrangement with the defendants for a supply of water. There had always been a deficiency of water for flushing and similar purposes; and he had repeatedly referred to it in his reports. During 1906 the supply was very inadequate, especially in the summer. There was an epidemic of diarrhœa, which he did not say was caused by the deficiency of water, but this was an additional difficulty in dealing with it. He made a special report about it. [Passages from the report were read.] Excluding Broomhill there were 2914 houses supplied with water; and according to the last census, there were 5·2 persons per house. There were also a few houses not supplied. The total population was upwards of 15,000. There were 88 baths and 102 water-closets; and it was his object to increase the number as far as possible. He considered a supply of 13 or 14 gallons per head reasonable.

Cross-examined: He excluded from his figures the houses supplied by the Company outside the Urban district, and he made no deduction for empty houses. He made his special report last summer in consequence of a letter from the Local Government Board.

Mr. *J. W. Harrison*, the District Surveyor to the Council, said he had not been able to water the roads efficiently or to flush the sewers properly for want of water. He sometimes had to send round water in carts.

John W. Wardle, a plumber and fitter in charge of the pumping plant up to Dec. 26 last, gave evidence as to keeping the meter register, and a book in which he noted any stoppages of the engine. This book

was in the bag which had been stolen. He had recently compared the book with the table now put in, which had been correctly copied from it. The valve controlling the 3-inch meter was altered once by the defendants' men to check the flow of water. This was done shortly after the pump was put there. On another occasion he remembered the reducing-valve being altered, which increased the flow of water. The valve belonging to the Council was never altered, except to stop the water when the engine broke down. His instructions were to keep the water out of the Jump reservoir until the Roebuck reservoir was full; but it never was quite full while he was there. The hourly meter readings varied from 4000 to 8000 gallons; they varied as much as 2000 gallons in one hour.

Cross-examined: He never knew the valves at Four Lane Ends altered before August, 1906, except on one occasion, when he put in a valve at the low side of the Jump reservoir, so as to send the water direct into the Wombwell mains. The ground had been opened before. After the valve was put in, the water could be sent straight into the mains at any time; but it was left shut off. He did not know who could have tampered with the valves at Four Lane Ends except the Dearne Valley people, to whom they belonged.

Re-examined: He never interfered with the defendants' valves in any way. The valve he put in near the Jump reservoir could not affect the amount of water coming to the spot. Witness explained in detail the alteration in the reducing-valve by the defendants, and also the sealing and riveting of the inlet-valves.

On another witness being called,

His Lordship suggested that further evidence of the same class did not seem very relevant to the questions at issue—first, whether defendants were bound to deliver water under pressure; and, secondly, what quantity plaintiffs were reasonably entitled to demand.

A discussion ensued as to the possibility of curtailing the evidence, or limiting the questions to which it should be directed; the result being that Mr. Eve said he would take the evidence as shortly as possible, and that when a convenient point was reached the further hearing should be adjourned until after the vacation.

Richard Middleton gave evidence as to being employed at the pumping-station, taking the meter readings, and booking any stoppages of the engine. He never interfered with the valves except for stop-pages.

Cross-examined: Mr. Burton told him to run the engine at full speed all night, and fill the Roebuck reservoir if possible, and let any surplus run into the Jump reservoir. But there never was any surplus.

Samuel F. Wardle, tap and water inspector, who took charge of the pumping plant from Christmas last to Easter, gave similar evidence to that of former employees. He said sometimes the flow of water would be very regular for hours together, and at other times it would vary considerably—quite perceptibly to the eye. Just about Easter, on an occasion when the defendants put in a new meter, there was an accident; and during the temporary stoppage thus caused, their men opened the ground and did something to the reducing-valve. Since then there had been plenty of water.

Thursday, May 16.

Wardle was cross-examined this morning in some detail as to the variation in the flow of the water, and insisted that he could see, by the way in which it was delivered into the tank, whether it was coming faster or slower. With regard to the alteration of the reducing-valve at Easter, he said he saw the men get down to the valve, and he knew they must have done something to it by the increased flow of water which had continued ever since.

Other employees having been called,

Mr. Eve said this concluded the present class of evidence, and he hoped that during the vacation the defendants would allow the plaintiffs' experts to inspect their Hoyland reservoir, controlling-valves, &c.

Mr. Astbury said the plaintiffs should see everything, on giving reasonable notice.

His Lordship suggested that a joint inspection should be made of the inlet-valves, which were riveted.

The further hearing of the case was then adjourned.

DUBLIN POLICE COURT.—Saturday, May 18.

(*Before Mr.* Swifte, K.C., *Divisional Magistrate.*)

The Quality of Dublin Gas.

To-day his Worship resumed the hearing of the case in which the Alliance and Dublin Consumers' Gas Company are answering three summonses for having supplied gas of deficient illuminating power (see *ante*, pp. 397, 468).

Mr. Ignatius O'Brien, K.C., and Mr. Philip White (instructed by Mr. Ignatius J. Rice) appeared for the Corporation; Mr. S. Ronan, K.C., and Mr. John Gordon, K.C., M.P. (instructed by Messrs. D. & T. Fitzgerald), represented the Company.

Professor *Lewes*, in cross-examination by Mr. O'Brien, said that in London the onus was thrown upon the supplying company of seeing that the meter was in proper working order. It was the duty of a gas examiner to make tests at least once in seven days. It was impossible to maintain a specified standard of illuminating power over the whole distributing system, owing to the various atmospheric and other influences, which a gas company had no means of coping with. If the gas at the testing-station was of 16-candle power, it might be lower or perhaps higher than this at a consumer's house. In order that the gas might be supplied of the proper illuminating quality, it was the invariable practice of gas companies to send it out of a higher power at the testing-station than that for which Parliament had provided. The fundamental fault of the system of gas testing was that the "candle-power" meant the largest quantity of light which could be obtained from the gas when consumed with a burner available for use by any consumer, but which should not add any foreign matter to the gas. The burner which gave the largest amount of light from a given volume of gas was the argand; but in Dublin, a flat-flame burner had been adopted, which, by dragging the gas out in a thin sheet of flame, and presenting a greater surface, used up all the surrounding air. They had, in fact, a standard which dragged down the illuminating power of the gas.

Mr. *W. F. Cotton*, the Chief Engineer of the Company, examined by Mr. Ronan, said they made at the works a considerable number of tests of the gas; and its quality and illuminating power differed a little from what was found at the testing-station. They had a photometer at the works.

Mr. O'Brien objected to these questions as being irrelevant.

His Honour, however, decided to accept the evidence.

Examination resumed: In addition to the photometer, they had a jet photometer, which afforded a rough test of the illuminating power. On the 29th of January, at four o'clock, the jet was not burning at its ordinary height. He searched for a leak, but could not find one. He also took every possible step to bring the gas up to the standard. Early next morning, he was called by the foreman, who told him that the hydraulic main on the first ten settings of retorts was red hot; and he at once shut off this section of the retort-house. When the main cooled, some of the joints were found to be leaking—the effect of which was to cause the exhauster to draw in air. On previous occasions, he had ascertained that where there was a leakage, and atmospheric air became mixed with the gas, it brought down the illuminating power. After cutting off the defective section, he had no difficulty in keeping the gas up to the standard. He attributed the leakage to the explosion that took place in the works on the 10th of January, as since the occurrence up to the present time he had been discovering escapes every day.

In cross-examination by Mr. White, witness said he found 28 leaky joints in 152 feet of pipes on the evening of the 30th of January. The cracks were caused by the explosion, and they gradually became larger until the main gave way; and the breaking of this caused the joints to leak.

In re-examination by Mr. Ronan, witness said the test first showed leakage at four o'clock on the 29th of January.

This closed the case for the defence.

Mr. O'Brien asked leave to call Dr. Teed to refute the evidence of Professor Lewes to the effect that Mr. T. J. Cotton had not made his tests in a proper manner. He said they were taken by surprise, because his Worship had allowed evidence of the kind to be given, and also decided to admit the reports of the late Professor Tichborne.

His Honour said he had no doubt that the admission of Professor Lewes's evidence had caused Mr. O'Brien surprise, because his case up to that point had been that Mr. T. J. Cotton was infallible.

Mr. Ronan said there could be no surprise, as Mr. Gordon had spent the greater part of a day in cross-examining Mr. Cotton on this very matter of carrying out the tests—as to how he did not make the necessary barometric and thermometric corrections.

Mr. O'Brien remarked that there was one kind of test for London and a different one for places outside.

His Honour said he would not admit any further expert evidence. There had already been a great expenditure of ratepayers' and shareholders' money, and, as he had originally said, it was a case that ought to be settled, even now.

Mr. Ronan then summed up the case for the defendants; laying stress upon the evidence of Professor Lewes, that the omission of the barometric and thermometric tests by Mr. T. J. Cotton might mean a difference of 3 candles in the recorded illuminating power. This, he said, rendered utterly unreliable the evidence he gave as an infallible gas tester. The witnesses for the Company tested the gas properly. But there was more than this in the case; for month after month the reports of Professor Tichborne showed that the gas was of the right standard. According to Mr. Cotton, 1200 times the gas was below it; but while Professor Tichborne was alive the Corporation never dared to commence proceedings against the Company for any of these 1200 deficiencies. On the evening of the 10th of this month, Mr. Cotton's test was 16 candles, while Professor Lewes's was 17 candles. No tribunal could act on the uncorroborated testimony of Mr. Cotton as a gas tester, when it was put in conflict with the evidence of men of experience in regard to the results of the tests they had made. The summons for the 29th of January was for a purely technical offence; and there had been attempts to make false charges against the Company in respect of the other two dates.

His Honour asked how the costs would be affected if he was bound to convict in one case.

Mr. Ronan said his Worship ought to dismiss the two summonses with costs; and on the third summons he ought not to impose a larger penalty than one farthing, and give no costs.

At this stage the case was further adjourned till Saturday, June 1, when Mr. White will address the Court on behalf of the prosecution.

Gas and Electricity Losses at Leigh.—The annual report of the Leigh Gas Department shows a loss on last year's working of £584, though the income has increased from £23,484 to £25,272. There has, it is stated, been a deficiency for several years, and the total is now £7054. The report of the Electricity Department also indicates a loss on the twelve months of £407, as against a profit of £219 the previous year. The number of consumers has increased from 279 to 315, and the units sold from 629,181 to 702,119. The loss is practically owing to the repayment of the first instalment of the loan of £14,365, which has made an extra charge on the works of £628.

Ludlow Water Supply.—A Local Government Board inquiry has been held at Ludlow, by Mr. R. H. Bicknell, into an application by the Town Council for sanction to the borrowing of £1850 for purposes of water supply (including the execution of certain works in the parishes of Bromfield and Ludford). The Town Clerk (Mr. J. H. Williams) stated that the population of Ludlow at the census of 1901 was 6328. The present water supply is obtained from two sources, both on land the property of the Earl of Plymouth, with whom the Council have perpetual agreements. It is proposed to build a new reservoir 120 feet higher than the present one, for the benefit of the higher districts of the borough. There were no objections to the application.

MISCELLANEOUS NEWS.

THE AFFAIRS OF THE WELSBACH COMPANY.

The new Chairman, the Right Hon. Lord Weardale, presided at the meeting of the shareholders of the Welsbach Incandescent Gas-Light Company, Limited, last Friday.

Changes on the Board.

There have been important and interesting changes in the constitution of the Board since the shareholders last met; and therefore it was a matter of propriety that his Lordship should first direct his remarks—in proposing the adoption of the report and accounts, and the declaration of a final dividend at the rate of 6 per cent. per annum on the preference shares and of 5 per cent. on the ordinary shares—to explaining these changes. Mr. Mattinson, he said, had frequently expressed his desire to be relieved of the duties and responsibilities of the chairmanship of the Company. Mr. Mattinson was a gentleman of great business capacity, and had large interests in various parts of the world, many of which took him frequently from home; and he felt he could no longer accept the burden of the chairmanship. The Board regretted this on many grounds; and perhaps chiefly because Mr. Mattinson's great legal knowledge and experience were of inestimable value at a time when the Company were engaged in a very large number of legal processes. When he (the Chairman) had the honour of presiding over the Advisory Committee, some five years ago, he really could not now quite call to mind the exact number of actions that were then pending in connection with the Company, but the number certainly ran into hundreds, and the expenditure in regard to them into many thousands. Their legal expenses were at the time no less than £16,000 per annum; but he was glad to say they were down last year to £11. In this matter alone, and on that item of law costs, the services of Mr. Mattinson had been very great indeed. They must also recognize the most valuable assistance he had rendered with regard to that very difficult and thorny subject—the separation of the "A" and "B" undertakings of the Austrian Company. This had been, as Mr. Mattinson informed the shareholders at the last meeting, successfully accomplished, with great advantage to the Company. They had very distinguished representatives on the Board of the Austrian Company; and their interests were safeguarded and controlled in a most efficient manner. But thanks were especially due, in the first place, to Mr. Mattinson's great ability in dealing with the separation of the "A" and "B" undertakings that their affairs and interests in the Company were most successfully maintained and established. The second resignation was that of Mr. Buchanan, who, for a time, was General Manager of the Company, and was until recently a member of the Board. The Directors regretted his retirement. The Chairman then passed on to refer to the loss through death of Mr. T. J. Brinsmead, who had an extensive knowledge of factory management; and it was chiefly due to him that the Company's factory at Wandsworth had now been established on such an efficient footing. Mr. Brinsmead had throughout been of the utmost service to his colleagues; and he (the Chairman) was sure he was only expressing the feelings of the shareholders when he said they regretted sincerely his untimely death. It was due to these losses that the Board, having regard to his (Lord Weardale's) former character as Chairman of the Advisory Committee, pressed upon him, with continued insistence, the desirability of maintaining unbroken, as far as possible, the continuity of policy which was established in the first instance by the Advisory Committee. He consequently yielded to their representations, and had accepted, with much diffidence, the chairmanship. He was a substantial shareholder in the Company, and he should endeavour to do the best for the shareholders as well as for himself. They had also been fortunate in obtaining the assistance on the Board of Mr. Crompton-Roberts.

Profits and New Business Premises.

Turning to the report, the Chairman said the net profits were slightly less than they were in the preceding year; but he thought he could give good justification for this result. The net profits from all sources amounted to £83,960, against £84,900 the previous year. A glance at the item of interest in the balance-sheet would show that the difference was more than accounted for by the reduced income from this source alone, due to the withdrawal of £28,000 required for the purchase of freehold property at King's Cross. The Board had no option in making the purchase; the Palmer Street premises being only leasehold. It was one of the most extraordinary things that the old Board did, to have proceeded upon so gigantic an undertaking as these leasehold premises in Palmer Street for 21 years only. It was unfortunately the fact; and consequently as the lease of an important section of these buildings fell in last year, a wedge was driven through the wholesale department, and rendered removal necessary. The business was transferred to the King's Cross premises before Christmas. The removal at the height of the season threw not only extra expense on the Company, but an enormous amount of extra work on the executive. The result, however, had gone far to prove that the new premises would make for efficiency and economy; Westminster having been a bad position both for trade and distribution.

Maintenance of the Trading.

Regarding the turnover, this had increased satisfactorily. The Company had sold more mantles, and more mantles of the best type. They had also sold more burners, and more lamps and lanterns; and the cash turnover had been greater than in the previous year. The business was steadily expanding; and this, in face of the great competition, was a result that must be considered highly satisfactory. As to the future, he could not possibly make any definite prophecy. The Board would make the best of existing conditions; and with respect to next year's trading, their contracts were in excess of any previous year for a like period. The Company were now proceeding on very different lines from those upon which the concern was constituted when it was first brought before the public. They were not depending upon any kind of monopoly now. The Company had made a great mistake in ever depending on it in the past. They were now carrying on their business in a free market. Their future was therefore dependent upon the conduct of the business being of a thoroughly economical and efficient character. They had in their friend Mr. Lawrence Fletcher a gentleman of whose abilities he could not speak too highly, and who conducted their business with the utmost efficiency. It did indeed require the utmost vigilance on Mr. Fletcher's part and on that of the Board in order to maintain their position, which he (the Chairman) was glad to think was the paramount position in this particular trade, against the keen competition which surrounded them.

Financial Points.

With regard to the balance of profit on the trading—after providing for salaries, travelling, office and miscellaneous expenses, rents, rates, taxes, insurance, advertising, and bad and doubtful debts—it was very nearly identical with the amount last year. It was £47,922, as against £47,915. This showed that the business was satisfactorily maintained. Several differences in the items in the accounts were pointed out and commented upon by the Chairman; but we will only refer to two or three here. The dividend received upon the 1470 shares in the Austrian Company in respect of the year ending March 31, 1906, was, the Chairman remarked, just the same as the year before, except that the Board had, during the last twelve months, acquired yet another share in the Austrian Company, which made the total return slightly larger. Speaking of the value of the undertakings and property of the Company, including goodwill, he said that what their goodwill and patents were supposed to be worth before the new Company was constituted ran into millions, yet the Company were then earning only £15,000 a year, whereas they were now earning £50,000. Whatever the goodwill might have been worth then, really its effective value was larger now.

Judicious Provision.

Coming to the question of the stock-in-trade, the Chairman described this as a matter of considerable importance, because the total had been increased from £60,379 in the previous year to £98,197 last year. Now this amount might, he thought, appear to be a very large one. But, in the first place, he pointed out that it was considerably less than it was in 1899. Then the amount of the stock-in-trade was over £154,000. He quite admitted that much of the money was wasted; but he did not think this would be found to be the case with their stock-in-trade now. He gave some particulars which had been supplied to him by Mr. Fletcher, and which, he thought, would entirely reassure the shareholders as to the effective value of the present large amount. The Directors had told the shareholders in the report that the abnormal increase was accounted for by favourable purchases of goods. This was a fact. The Managing-Director entered into a contract for two years' supplies of the burners sold by the Company; and since then the prices had advanced by 20 to 25 per cent. In glass, in which the Company were doing an enormous and constantly increasing business, prices had advanced 10 per cent. since they, in like manner, bought extensive stocks. Until last year the Company's supplies of glassware were largely obtained through London merchants, who held the stock for them, and naturally charged them high prices. The new arrangement necessitated the Company carrying the stock themselves; but it saved upwards of 10 per cent. in the purchase prices. Then he came to the mantle factory, where they found a very large increase in stock; and he was assured it was due particularly to one cause. The management found that, in such a highly competitive business, it was impossible to continue to manufacture the gigantic output of mantles on a cotton foundation, so long as the price of cotton was the subject of the violent fluctuations experienced of late years. The Board therefore decided to adopt ramie; and a large purchase of this material was completed at satisfactory figures. The Company's position in this respect was on a favourable basis, as this practically assured them for another year. Had the Company continued the use of cotton, the Directors would have had to report to the shareholders that some £6000 less had been made. They had saved in one year the whole of the money spent in extending and duplicating the plant at the factory, where they now knitted every mantle made. The change from cotton to ramie had been carried through without a hitch under the superintendence of Dr. Schoder, the Company's able Works Manager. The Company's mantles he could claim were now of better quality than ever before. To avoid misunderstanding, he should say they still made one series of cotton mantles—the Plaissetty—under licence; and therefore the Company were in an excellent position for catering for both ramie and cotton mantles of the best types known.

Cash and Investments.

Passing to the cash and investments, his Lordship said they had decreased from £173,980 in the preceding year to the sum of £123,542 last year. This diminution was due to the freehold building now being erected at King's Cross, and to the large increase in the stocks; and, in both these cases, the Board thought they had more than value for the money.

The Austrian Company—Monazite Sand and Thorium.

Respecting the Austrian Company, he said the Directors who represented the Company on the Board of the concern had recently returned from Vienna, and had given their colleagues a satisfactory account of the operations of the Company. He (the Chairman) had himself some years ago the pleasure of making the acquaintance of the leading gentlemen there; and he then formed the highest opinion as to their value—an estimate which, he was glad to say, had been entirely justified by subsequent experience. And they were glad to know that besides these able gentlemen who were conducting their operations there now, there were young men who were rising to positions of responsibility; and as the older men passed away, they would be able to fill their positions with efficiency and skill. Therefore he had nothing but good to say regarding the Austrian Company. They were holding their own there very satisfactorily, notwithstanding that the Austrian patents had now entirely expired, and that the Company had to carry on their operations in a free market as their own Company had to do in this country. That the Austrian Company were holding their own was testified to by the fact that the Company were receiving this year, as last, 30 per cent. upon their holding. They would, therefore, have

in hand, by the payment of the dividend just received, the whole interest upon the preference shares for the coming year. There was one other subject upon which he ought to say a few words. It was one of much importance, although of great delicacy. It might be asked how the Company stood with regard to monazite sand and fluid. Upon this he could only say that, in the future as in the past, the Directors would exercise diligence, forethought, and care. They would not, he hoped, be caught asleep; they would not, he hoped, commit any imprudent act. Their present was satisfactorily assured; and so he thought would be their future. He hoped, however, the proprietors would understand that, in a business like theirs, it was of importance not to give away any trade secrets whatever to competitors.

After Mr. W. W. Wright, the Vice-Chairman, had seconded the motion, there were a few inquiries for information respecting sundry items in the accounts, and the motion was then unanimously carried. The retiring Directors and Auditors were re-elected, the Chairman was thanked, and the shareholders placed on record their gratitude to Mr. Mattinson, K.C., the late Chairman.

MONTE VIDEO GAS COMPANY, LIMITED.

Good Outlook for Business—Mr. Hunt on his Visit to Monte Video.

The Ordinary General Meeting of this Company was held last Thursday, at Winchester House, Old Broad Street, E.C.—Mr. T. C. TATHAM in the chair.

The SECRETARY (Mr. Henry Kearns) read the notice calling the meeting; and the Directors' report and the accounts were taken as read.

The CHAIRMAN, in moving the adoption of the report and accounts, said it would be seen on the debit side of the balance-sheet that no alteration had been made in the capital receipts, which stood at £570,600. All the bearer debentures had been paid off, as was stated in the accounts to December, 1905. The reserve account, which stood at £23,760, and the insurance fund, which stood at £12,500, remained unaltered. The next item, "reserve for renewals," had been increased this year by the addition of £1000; and now amounted to £1500. It would be desirable to still further add to this sum as opportunity offered, as it was intended to reconstruct one of the retort-houses. This it was proposed to do, when the time came, entirely out of revenue. In the new retort-house they would, of course, adopt the most modern methods, by which they hoped to obtain better results with a reduction in the fuel account. The contingency account at £15,594 was £926 less than the previous year. As the shareholders were aware, the Company's investments which represented the reserve account were valued in the balance-sheet at their market value, and not at cost. In common with most other securities, those the Company held had fallen in value; and the Directors therefore took from the contingency account the amount which they kept in reserve against any depreciation in value. Passing to the credit side of the balance-sheet, it would be observed that the Directors had written off capital expenditure for depreciation £4720, *plus* a further £140 realized for some old plant which had been sold. This was an increase of £998 on the previous year. They had added during the year the cost of new and additional mains, services, and meters, amounting to £3185—an increase of £1924. From the total expenditure of £593,389, the Directors had written off £50,240—the amount which was provided by the reserve account for the redemption of debentures. It was the rule in many companies to write off from capital expenditure each year the amount of debentures redeemed during the year; but in their case, as the holders of debentures could at any time before their debentures were drawn, exchange them for stock, they could not know exactly the amount which would be required for debenture redemption. They therefore waited until the whole issue had been redeemed, and had now taken the liability out of the debit side of the balance-sheet. Thus the capital expenditure was reduced to £543,149. After referring to the small variations in the stocks, the Chairman said sundry debtors and outstanding accounts amounted to £12,687. This sum was arrived at after deduction of every bad and doubtful debt known to the Directors, and might therefore be regarded as an entirely good asset. In comparison with December, 1905, the item showed a reduction of £1022. The investments in British, Colonial, and Foreign stocks, shares, and bonds were valued at £926 less, owing to depreciation in their market price, while other property exhibited a net increase of £6423. In explanation of this, he said the Directors had bought an important corner piece of land on which they intended to erect offices and show-rooms for the use of the Company, with two or three floors above, which they expected to be able to let to give a good return. That the purchase of the land was a satisfactory one was shown by the fact that they had since had two would-be purchasers, both at increased prices. The present offices and show-rooms, for which the Company paid nearly £800 a year rent, were not in nearly so commanding a position; and the Board anticipated that, when they removed to the new building to be erected, the gas-fittings department would give increased returns, and that the investment would turn out well for the Company. Dealing next with the revenue account, he said he was sure the shareholders would be gratified to know that, notwithstanding the heavy reduction which was made in the price of gas, and which affected the first three months of the year, in comparison with 1905, the receipts from the sales of gas, residual products, meter-rents, and fittings all showed satisfactory expansion, and amounted to a total increase of £6821; while those from the dock department had increased by £2908. On the other hand, it was a cause for regret that these good results were to a large extent neutralized by the heavy increase in the cost of materials, higher coal freights, and the increased wages the Company had to pay in Monte Video, besides the reduced hours worked by the men. The increased sales of gas naturally necessitated a larger expenditure on coal; and more coal had been used as fuel in the manufacture, leaving more coke available for sale. So far there was nothing to complain about. The higher wages and reduced hours, however, forced upon the Company by the continued labour agitations had told against the profits for the year, and could not fail, he feared, to affect the Company this year. Notwithstanding these adverse circumstances, it was satisfactory to find that the net revenue had slightly increased; and the returns they had received for the current year showed further increases in the gas sold for lighting, gas-engines, stoves, and industrial purposes, showing that the advantage of gas for lighting and for use as a fuel was being more appreciated in Monte Video by reason of its cheapness, cleanliness, and adaptability. Turning to the profit and loss account, on the debit side it was satisfactory to find that the bad debts of the year amounted to only £467—good evidence, he hoped, of the increasing prosperity of Monte Video, and of the careful manner in which the Company's affairs were superintended by their representative. After providing for interest on the debenture stock, income-tax, depreciation, and reserve for renewals, and deducting the dividend now recommended, they added £251 to the undivided balance, increasing it to £10,937.

Mr. CHARLES HUNT, in seconding the resolution, said he was glad to avail himself of the suggestion of the Chairman that he should say a few words with reference to his recent visit to Monte Video. He found the Company's works, dock, and machine shops in excellent order and condition, and in a state of efficiency which reflected the greatest credit upon Mr. Lane, the General Manager, Mr. Thomas, the Engineer, Mr. Gillespie, who was in charge of the dock and repairing department, and those who were acting under their direction. It was all the more to their credit, owing to the exposed position of the works on the coast, and their liability, in consequence, to be affected by the sea and salt spray, more than the usual amount of vigilance was necessary to keep everything in good working order. The works were capable of producing more gas than was at present required; but one of the retort-houses, which was an old structure, would before very long need to be reconstructed. He saw what he believed to be unmistakable signs of improvement in business. New houses were being built in considerable numbers, and old one-storey houses replaced by others of two and three storeys in height. The suburbs were spreading out in several directions, and altogether there was every indication of prosperity in Monte Video. To keep pace with the extension of the City should this continue, as the Directors hoped it would, it would be necessary during the next few years to considerably extend the mains; but, of course, the expenditure incurred in doing so would be productive. The property which they had purchased for new offices and show-rooms was a very advantageously situated corner site, having a good frontage to one of the leading thoroughfares along which there was a tramway route. It was also within a short distance of the principal square; and its two extensive frontages would give exceptional facilities for advertising. It was extremely satisfactory that the use of gas for cooking and also for industrial purposes and motive power, was extending; and it was believed that there was a considerable field for the use of small engines. He need hardly say that it was the endeavour of the Board to encourage such consumption by making the price of gas as low as possible for these special purposes. With regard to the use of gas generally, the last reduction of price had made it more popular, and a considerably increased output was now probable. He thought it would be sound policy on their part to make a further reduction of price as soon as practicable. This would be the best and surest way of gaining new consumers, and an increased output would be the means of reducing the cost of manufacture and distribution.

The motion was unanimously carried.

Proposed by the CHAIRMAN, seconded by Mr. SIMPSON ROSTRON, a dividend was declared of 8s. per share, making with the interim payment of 6s. per share (less income-tax), a dividend of 3½ per cent. for the year.

On the proposition of the CHAIRMAN, seconded by Mr. HUNT, Mr. Simpson Rostron was re-elected a Director; and on the motion of the CHAIRMAN, seconded by Mr. ROSTRON, Mr. Hunt was returned to his seat at the Board.

Moved by Mr. T. WILKINS, and seconded by Mr. F. W. CHURCH, Mr. George Sneath and Mr. Laurence E. Halsey were elected Auditors; the former Auditors not offering themselves for re-election.

A hearty vote of thanks was passed to the officers and staff in Monte Video and to the Secretary and the London staff, on the motion of the CHAIRMAN, seconded by Mr. ROBERT MORTON; and a similar compliment was paid to the Chairman and the Board.

BOLTON CORPORATION GAS UNDERTAKING.

Working Results and Allocation of Profits.

The accounts of the Bolton Corporation gas undertaking for the year ending March 31 state that the revenue from the sale of 938,634,000 cubic feet of gas for public and private lighting (less discounts) was £117,450, that residuals produced £36,181, and that the total receipts were £156,236, against £159,157 the preceding year. The expenditure on the manufacture of gas was £73,302; on distribution, £9248; on rents, rates, and taxes, £8635; on management, £1997; and other expenses made up a total of £94,035, compared with £91,072 before. The balance carried to the profit and loss account is £62,201, against £68,085. After providing for annuities, interest on loans, and the sinking fund, and appropriating a sum of £20,000 in aid of the rates, the remainder, amounting to £16,414, has been placed to the reserve fund account. The total net capital expenditure on the undertaking amounted on March 31 to £630,665, or at the rate of £630 os. 8d. per million cubic feet of gas made, £6 9s. 6d. per ton of coal carbonized, and 13s. 5d. per 1000 cubic feet of gas sold. Since the works were transferred to the Corporation in 1873, a total gross profit of £1,659,060 has been made, £394,033 has been paid in annuities, £143,230 for interest, £187,843 for dividend, £71,347 to sinking fund, £368,529 carried to the reserve for renewals, &c., and £494,076 applied in aid of the local rates.

The report of the Gas and Lighting Committee expresses regret at the severe illness of the Chairman (Alderman James Horrocks, J.P.) and of Mr. Robert Fairclough, and at the removal by death of three members of the Committee. The Gas Engineer (Mr. William Smith) certifies that the gas-works and plant are in good condition, and, further, that the undertaking is really of far greater value than the

amount of capital liability standing against it in the books of the department. The substitution of incandescent for flat-flame burners in the street-lamps of the Central, Rumworth, and Halliwell districts, which has been proceeding gradually since 1899, will during the coming season be thoroughly completed. The economy effected in the consumption of gas by the change of system is very considerable; while the improvement in the quality of the street lighting is most marked. At March 31, the number of lamps in the borough was 5325; and adding 786 for Turton and Horwich districts, there was a total of 6111 lamps supplied with gas by the department at that date.

The report furnishes the following comparative statistics.

	Year 1907.		Year 1906.
Tons of coal and cannel carbonized	97,404	..	93,781
Average cost per ton delivered on the works and trimmed	9s. 8¾d.	..	9s. 10¼d.
Percentage of cannel used	0·04	..	0·77
Gas made, cubic feet	1,001,020,000	..	972,031,000
Gas made, cubic feet per ton carbonized	10,277	..	10,366
Gas accounted for, per ton carbonized	9,740	..	9,874
Gas unaccounted for, per cent.	5·22	..	4·74
Maximum quantity of gas supplied in 24 hours, cubic feet	5,939,000	..	5,453,000
Minimum quantity supplied	806,000	..	881,000

As briefly mentioned last week, when the proceedings of the Committee were submitted to the Town Council at a special "budget" meeting, there was a discussion with regard to the proposal to allocate £20,000 towards the relief of the rates. It was opened by Alderman Haslam, who moved an amendment referring back the paragraphs relating to the matter. In doing so, he pointed out that some years ago the Council passed a resolution practically limiting the amount to be paid by trading departments in relief of the rates; and so far as he remembered, it was to the effect that only 2½ per cent. be allowed to go in this direction—the remainder to be put to the reserve fund. For two years they had exceptional circumstances. Great pressure was put on the Gas Committee last year; and the matter was absolutely referred back to them. They agreed to vote £20,000 out of the profits, with the distinct reservation that it was not to create a precedent. Where were the excptional circumstances this year, except the fact that for once the rate was reduced? Why should the department be asked to pay a greater amount to profits than the resolution provided? Property owners were being relieved to the extent of 2s. 6d. for each pound their tenants paid for gas; and large consumers were contributing an equal sum for every pound's worth of gas they consumed. This was a great hardship upon firms who used a large amount of gas for business purposes over and above other firms who generated their own electricity, and did not have any gas bills. This matter was getting to be a great infliction and a very great injustice. There was another point to which he strongly objected—that was, the conduct of the Borough Treasurer, who, at the meeting of the Gas Committee on Feb. 3, sent word by a committee clerk asking for a grant of £20,000. At that time the accounts were not before the Committee. The Treasurer knew this perfectly well, and that they would not be in a position to go into the matter further than having a simple statement before them that probably the results would be so much. Here was a question of importance pushed upon a Committee by an official. He (the speaker) was the mover of the original resolution limiting the allocation to 2½ per cent.; and he did it from previous experience, finding this identical "rushing" of these matters by an official of the Corporation. He moved the matter back, with a view to bringing to a crisis the question as to whether a resolution of the Council was to be set at defiance in this way.

The amendment having been seconded, Alderman Brown deprecated the attack on an official who had a difficult duty to perform. In getting out the estimates, he wanted to place them on as good a footing as possible. He (the speaker) was sorry Alderman Haslam disagreed with him in trying to get the rates down. Evidently he was troubled because the rates were being reduced. He would perhaps like to see them go up, and the cost of gas reduced. The price was, however, not very high in comparison with neighbouring towns. He thought the Treasurer's action very proper. He himself would not hesitate to mention the matter to any Committee, and ask them to allocate as much of their profits as possible for the relief of the rates. He did not see why they should all go to the reserve fund. They were told by the Manager, in his report, that the assets were very much greater in value than they stood at. Under these circumstances, why should they build up a reserve fund, or why should they reduce the price of gas? Why should they reduce the price to the consumer, and not allow the general ratepayer, who had the undertaking to back up, and had the responsibility of seeing that the works were properly carried on, to have any share of it? He quite agreed with Alderman Haslam that the resolution as it was passed was not as definite as it ought to have been. The idea of the movers was that the amount should not be less than 2½ per cent. They favoured the principle that if the Corporation undertook municipal trading, and a profit were made, it should go for the benefit of those responsible; and they fixed in their mind that 2½ per cent. was the minimum profit they ought to get from the undertaking, and that the price charged should not be such that they would make less profit than 2½ per cent. on the capital. If the Committee could make a larger profit, and transfer it for the benefit of the ratepayers, they might do so, and still put something to reserve. Had the amount been kept down to 2½ per cent., a considerably less sum than £20,000 would have had to be allocated, and the rates would have had to go up. It was not decreased expenditure which was reducing the rates, but the amount of profit they were deriving from municipal trading.

In response to a request by Alderman Miles, the Town Clerk read the resolution passed by the Council in 1902, which was to the effect that, in their opinion, the yearly contributions of the Gas, Electricity, and Tramways Departments in aid of the rates should be expected to yield 2½ per cent. on the loan capital. Continuing, Alderman Miles said, in justice to the Treasurer, that he did not think he went or sent to the Gas Committee with a view to coercing them in the matter. He was afraid there were some members of the Council who did not care in regard to any proposed increase of rates. Personally, he was a strong advocate of the reduction of the rates where it could be legitimately carried out. This was not the largest sum the Gas Committee had given. On one or two occasions they had allocated £26,000; so that the amount of £20,000 was not an extraordinary one. They had been reducing the capital of the undertaking year by year; and if the Committee could make the allocation without interfering with the finances of the department, he thought it was their duty to do so.

With reference to the position of the undertaking, Mr. Tootill pointed out that £196,000 of the capital account was still undischarged, and that renewals were needed in connection with the Lum Street retort-house; and he contended that the department would not be on a proper basis until the capital account was reduced to 10s. per 1000 cubic feet. Dr. Young, a member of the Gas Committee, observed that the £20,000 allocated in relief of the rates would please the ratepayers; while Mr. Waddington urged that the question was one of the equitable distribution of the burdens. He pointed out that there were large consumers who made their own electricity, and did not use any gas. Mr. Horridge asked, assuming the works were unremunerative, who would make good the loss; and Alderman Hibbert inquired if any members would consider 2½ per cent. an inflated profit in their own business. Mr. Hargraves contended that the general body of ratepayers would be better served by a reduction in the price of gas. As an additional reason for this course, he urged that out of the £20,000 they would have to pay £1000 as income-tax, and ratepayers would not benefit by that. Alderman Hesketh thought each department should stand on its own bottom; and gas consumers ought not to be asked to pay more than their due share of the expenditure of the borough. The fairer way was to reduce the price of gas to such a figure as would enable 2½ per cent. to be handed over to the rates.

On a vote, the amendment was defeated by 37 votes to 26.

GERMAN GAS AND ELECTRICITY WORKS.

Annual reports of some German gas companies, of which extracts have been published in the newspapers, refer to the increase in the price of coal in 1906, and state that a further advance is taking place in the current year. In the case of one company, it is mentioned that prices have reached an unprecedented height, and that little reliance can be placed upon any reduction being made. The hope is, however, expressed that by means of the higher rates obtained for coke, and by larger sales of gas, it will be possible to equalize matters; but the large supply of tar and other residuals prevents any advance in the prices of these products. Some of the companies also own electricity works; and there seems to be a disposition to increase the number in gas proprietorship in order to obviate hostile competition.

The Silesian Electricity and Gas Company of Breslau, which has a share capital of £330,000 and a bond issue of £333,000, own two central electric lighting stations at Chorzow and Zaborze respectively, and gas-works at Glogau. The increase in the consumption of energy delivered from both electricity works amounted to 11·3 per cent. for private lighting in 1906, compared with the previous year; while the advance for power purposes, particularly for the mining and iron and steel industries, reached 50·9 per cent. An augmentation of 10 per cent. took place in the sales of gas at the works, and those of the residual products also rose to a corresponding extent. The total net profits in 1906 amounted to £34,196, compared with £31,347 in the previous year; and a dividend has been declared at the rate of 8½ per cent., against 8 per cent. for 1905. It is now proposed to increase the Company's share capital by a fresh issue of £110,000 in shares, in order to provide for extensions of the three works.

The Gas and Electricity Company of Cologne own 23 gas-works and those for the supply of electricity at Neheim. According to the Directors' report for 1906, the consumption of gas increased by 10½ per cent., as compared with an advance of 6½ per cent. in the preceding year; and there was also an augmentation in the turnover at the central electric lighting station. The larger revenue from the sales of gas was, however, almost entirely absorbed by the materially higher wages which had to be paid, particularly at the works in the Ruhr. The accounts show net profits of £32,221 for last year, contrasted with £31,473 in 1905; and a dividend has been declared at the rate of 6 per cent.—being the same rate as before.

The General Gas Company of Madgeburg celebrated its Jubilee last year, and experienced a larger increase in the consumption of gas than in the preceding years. The Company own 15 works, and practically control three others; and the total advance in sales was 7·4 per cent. in 1906, against 6·25 per cent. the previous year. As net profits, the accounts indicate the sum of £19,515, compared with £20,721 in 1905; and a dividend of 7 per cent. has been declared—this rate being the same as the previous twelve months.

A few other Companies may be briefly noticed. The Directors of the General Gas and Electricity Company of Bremen, which is financially interested in 42 works, have declared a dividend of 5½ per cent. for the past year, compared with 6 per cent. in 1905. The Thuringia Gas Company, who own two electric lighting stations in addition to gas-works, distribute 16 per cent. for both years. The United Gas-Works Company of Augsburg, with 20 gas and 3 electricity works, pay 9 per cent. for 1906, against 8 per cent. in 1905. The Gaarden Gas-Works Company of Gaarden, near Kiel, distribute 8½ per cent. for 1906, as in the preceding year.

The financial statement of the Halifax Corporation for the past year has been presented to the Finance Committee. The income and expenditure were expected to be about equal; but a surplus of £14,000 was reported. This satisfactory result was stated to be due to the gas and Electricity Committees having made larger profits than was anticipated, to the loss on the tramways not being as great as was expected, and to the fact that a number of the Committees had kept below the amount of their estimated expenditure.

LANCASTER CORPORATION GAS SUPPLY.

The Past Year's Working.

The Gas Engineer and Manager of the Lancaster Corporation (Mr. Charles Armitage, Assoc.M.Inst.C.E.) has presented to the Gas Committee his report on the results obtained at the gas-works of the Corporation in the year to the 25th of March last. The total revenue was £28,873; and the expenditure, £18,971—leaving a gross profit of £9902. This was disposed of as follows: Interest on stock and mortgages, £3679; redemption fund, £1653; income-tax, £490; borough fund, £2000; reserve fund, £2080. The last-named fund now amounts to £10,057. To the redemption fund £1652 was added during the year; making it, with the accrued interest, £29,531. The receipts for gas amounted to £14,729—an increase of £290. Of prepayment meters, 2675 had been fixed, and the receipts for the past year amounted to £4616, or an increase of £144. The net receipts for public and private lamps were £187. To the former, 15,786,601 cubic feet of gas were supplied free of charge. This was equal to the sum (at 2s. per 1000 cubic feet net) of £1578. The average price received per 1000 cubic feet of gas sold was 2s. 0·13d. This sum was absorbed as follows: Net cost of gas, 11·55d.; new mains, services, meters, and prepayment stoves, 0·9d.; interest on stock and mortgages, less interest from Banking Company, 4·54d.; redemption fund, 2·06d.; to borough fund, 2·49d.; to reserve fund, 2·59d. The average cost of coal was 11s. 0·52d. per ton, against 11s. 0·8d. in the preceding year. Coke contributed in return 5s. 0·51d., and the products from tar and ammoniacal liquor 3s. 6·48d.; making a return for residual products of 8s. 6·99d. per ton of coal carbonized, or 77·71 per cent. of the cost of coal. The total quantity of gas sold and used at the works and offices during the twelve months was 195,460,452 cubic feet—an increase of 5,139,632 cubic feet, or 2·7 per cent. Mr. Armitage attributes this small increase in the consumption to the adoption of incandescent lighting, which gives a great increase in illuminating power with a smaller consumption of gas. He adds that the stoking machinery and the coke conveyor, which have been described in the "JOURNAL," are now completed, and working satisfactorily.

MIDDLETON CORPORATION GAS DEPARTMENT.

The Past Year's Working.

The Engineer and Manager of the Gas Department of the Middleton Corporation (Mr. J. Carter Moon) has presented his report and working statement for the year ending the 31st of March. He shows that the outlay on capital account in the twelve months was £688, made up of £291 for meters and £397 for mains and services. The quantity of gas sold was 120,392,900 cubic feet; being an increase of 7,387,800 cubic feet, or 6·13 per cent., compared with an increase of 2·27 per cent. in the year 1905-6. It was equal to 9163 cubic feet per ton of coal carbonized, or 220 cubic feet per ton more than before. There was increase of 15·83 per cent. in the gas supplied through prepayment meters, and of 3·71 per cent. in that used in stoves and for motive power; while in the case of the supplies to cottages, shops, mills, and for public lighting, the decreases of the year 1905-6 were converted into increases in the twelve months just closed. There was a decided improvement in the leakage, which was only 7·6 per cent., against 8·89 per cent. before. The quantity of gas made was 132,940,000 cubic feet—an increase of 6,182,000 cubic feet, or 4·65 per cent., over the preceding year; the coal carbonized being 447 tons more, and the make of gas per ton 130 cubic feet more. The expenditure on coal, cannel, and benzol was £7897, compared with £7965 in 1905-6; the mixture having cost 12s. 0¼d., against 12s. 6¼d. a ton. During the coming year, however, owing to the rise in the price of coal, Mr. Moon says this item will show an increase of 2s. to 2s. 6d. per ton, amounting in all to about £1400. Coke produced an increased revenue of £211; the quantity available for sale being 187 tons more than last year, and the price obtained showing a slight improvement. In tar, ammoniacal liquor, and sulphate of ammonia, on the other hand, there was a decrease of £247; leaving the total sum realized by residuals less by £36. The revenue for the year amounted to £23,631, and the expenditure (less annuities, interest, and sinking fund) to £16,086; leaving a gross profit of £7545, against £6509 before—an increase of £1036. The net profit is £1117, compared with £184; being a very satisfactory increase of £933.

WEST BROMWICH GAS UNDERTAKING.

Annual Report.

The report on the working of the gas undertaking of the West Bromwich Corporation for the year ending the 31st of March last, was issued on Saturday. We take from it the following particulars.

The loan indebtedness on the undertaking is now £140,549; a reduction of £8632 having been made during the year. There still remains in the sinking fund a sum of £3553, which deducted from the loan debt leaves a net indebtedness of £136,996, equivalent to 8s. 4d. per 1000 cubic feet of gas. The capital account was augmented by the cost of new stoking machinery and coke-handling plant erected during the year, which has been defrayed out of revenue, and not by further borrowings. The assets were written down to the extent of £300 in respect of machinery superseded by this equipment. The total sales of gas, including the gas used for public lighting, amounted to £40,674—a decrease of £374 on the preceding year, in consequence of the reduction made in the price of gas for ordinary lighting, and a further reduction in the case of gas used for manufacturing purposes and for motive power. The total quantity of gas sold was 328,476,913 cubic feet—an increase of 4,661,259 cubic feet, spread over all classes of consumers. The gas unaccounted for was 17,237,087 cubic feet, equal to 4·9 per cent. on the make; being an increase of 0·75 per cent. on the previous year. The number of houses in the borough last November was 14,492, of which number 5190 are supplied with gas through ordinary meters, and 5637 by means of prepayment meters—a total of 10,827. The total number of consumers of all kinds at the end of the financial year was 11,142; being an addition of 186. The aggregate income from the residual products last year was £753 in excess of that of the previous year, owing to a heavier carbonization of coal, with the consequent increase in the quantities of the products. The quantity of coke used in heating the retorts was 4381 tons, representing 22·6 per cent. of the production; and 505 tons were used in the manufacture of water gas.

The total income from all sources was £56,718, against £56,267 the previous year; and the total expenditure was £43,176, compared with £42,673. The total manufacturing charges, including maintenance of works and plant, amounted to £31,497; being an increase of £542. It is explained that this was caused, to some extent, by the decreased quantity of gas obtained from the coal immediately after installation of the new stoking plant, when the machines did not for a time develop their full power and capabilities.

The analytical table in the report shows that 29,938 tons of coal were carbonized, yielding 321,840,000 cubic feet of gas, or an average of 10,750 cubic feet per ton. The coke used in the manufacture of water gas was 505 tons, which yielded 29,847,000 cubic feet, or an average of 59,103 cubic feet per ton. The total quantity of gas made was therefore 351,687,000 cubic feet—an increase of 8,717,000 cubic feet. The total cost of distribution and the maintenance and renewal of meters, mains, and services, was reduced during the year by £527; little work having been done on new mains or alterations. The total length of mains at the end of the financial year was 46 miles 640 yds. The total number of consumers per mile of main is 240; and the quantity of gas sold per mile, including that used for public lighting, was 7,084,800 cubic feet. The cost of public lighting was £267 more than in the previous year, owing to experiments having been made in the lighting of various parts of the borough, and to an increase in the number of lamps.

The gross profit on the trading accounts is £13,642, against £13,593 in 1905-6. The balance standing at the credit of the profit and loss account at the commencement of the year was £15,849, out of which a contribution of £1365 was made to the relief of the general district rate, and £755 was set aside to defray the cost of the new coke-handling plant and £1000 for the stoking machinery. The sum of £1900 was transferred to the credit of the extensions suspense account; leaving a net balance of £10,829 (the same as last year) to be brought forward. The net revenue account was charged with interest on loans and corporation stock, and the proper instalments towards the redemption and extinction of the debt. The surplus for the year was £5106, compared with £5020 before—an increase of £86, notwithstanding the somewhat considerable reduction in the prices charged for gas. The amount of the debit balance on this account was reduced by £1900, transferred from the profits of the previous year; leaving a balance of £13,036.

DUKINFIELD GAS UNDERTAKING.

The Past Year's Working.

In the "JOURNAL" for the 14th inst. (p. 468), brief reference was made to the past year's working of the Gas Department of the Dukinfield Corporation. We can now furnish some additional particulars from the report of the Manager (Mr. W. Lindley). He states that the carbonizing plant worked satisfactorily during the year; the yield of gas per ton of coal carbonized being 11,377 cubic feet. The quantity of gas sold was 84 million cubic feet; being an increase of 3 millions on the sales during the year 1905-6. The total gas accounted for was 84,575,600 cubic feet, apportioned as follows: Cottages, ordinary gas-meters, 42,328,800 cubic feet; do., slot-meters, 8,728,800 cubic feet; mills, 26,239,060 cubic feet; public lamps, 6,019,381 cubic feet; and offices, works, &c., 1,259,559 cubic feet. A table giving the cost of gas per 1000 cubic feet sold shows that the total expense of production was 2s. 6·61d. As the average price of gas is 2s. 5·92d., there was a loss last year of 0·69d. The balance-sheet shows that the revenue for the year was £13,652, and the expenditure £10,613; leaving a balance of £3039, against £4039 for 1905-6. But £200 more was spent for coal, £277 more on repairs, and the rates and taxes were increased from £753 to £1036 as the result of a re-assessment of the works. After payment of the annuities, the interest on loans, the instalment of the sinking fund, and the bank interest, there was a loss of £242, which reduces the balance on the profit and loss account from £2048 to £1806. As already reported, a proposal was brought forward at the last meeting of the Town Council to raise the price of gas 2d. per 1000 cubic feet; but the matter was referred back to the Gas Committee.

STOWMARKET COUNCIL AND THE WATER-WORKS.

Decision Not to Purchase.

Last March, a Local Government Board inquiry was held at Stowmarket (see p. 762), with reference to an application by the Urban District Council, under the Stowmarket Water Order of 1887, regarding the purchase of the local water undertaking, and the borrowing of £10,000 for the purpose. The supply is derived from a well, on property known as the Stowmarket Brewery; and it was stated at the time of the inquiry that the owners were not anxious to sell. The sanction of the Local Government Board to the purchase, and to the borrowing of the necessary money, has since been received; but meanwhile new members have been elected to the Council who are under promise to oppose the scheme. Under these circumstances, the vendors informed the Council that they were willing to annul the contract entered into, and that they would not make any claim for the expenses they had incurred in the matter.

Last week a special meeting of the Council was held to discuss the question. It was then stated by the Clerk that the loan was granted for repayment in twenty years, instead of the thirty years he anticipated. He had telegraphed to the Board on the subject; and they said they did not think the time could be extended. At twenty years, it would mean an annual charge of about £200 more. After some discussion, it was agreed, on the casting-vote of the Chairman, that the works be not purchased.

METROPOLITAN WATER BOARD.

The Ordinary Fortnightly Meeting of the Board was held on Friday—Sir MELVILL BEACHCROFT in the chair. It was the last assembly of the present Board, who, under the provisions of the Metropolis Water Act, 1902, will go out of office on the 1st prox.

The CHAIRMAN, in the course of an interesting review of the work during the past four years, said the first period of the Board's existence was the most difficult, as it was during it that they were engaged in what he supposed was the biggest arbitration on record. The claims of the Water Companies, which were for £51,000,000, were settled for about £31,000,000; the costs incurred by the Board amounted to £142,555, and the costs of the Companies paid by the Board to £91,168. The expenses of the Court of Arbitration amounted to £25,237; but from this sum should be deducted an amount of £3081 which was generously returned to the Board by Sir Edward Fry, as well as £1140 by Sir Hugh Owen. In addition to the liabilities which were thus placed upon the Board, they took over the debenture stocks of the Water Companies, representing a further capital liability of about £12,000,000; and they also had to pay £219,287 by way of compensation to the Directors for loss of fees, and £213,294 to the Government as stamp duty on the vesting of the undertaking. The income of the Board was estimated to amount, in the year ended March 31, 1907, to £2,814,510, representing an increase of £145,208 over the income of the Water Companies during the last year of their existence. While the estimated surplus of the Board for the year 1905-6 was £20,807, and the actual surplus for that year £11,838, the estimated surplus for the year 1906-7 was £49,493, which, however, was likely to be reduced. So far it must be admitted that no saving had been effected. The Board had the responsibility of maintaining works which would provide an uninterrupted supply of water to nearly 7 millions of people, who consumed on an average something like 225 million gallons a day. The works were spread over an area of over 500 square miles. The present storage capacity, including the "Knight" and "Bessborough" reservoirs which were recently opened, amounted to some 8884 million gallons. The reservoirs about to be constructed in the Lea Valley and at Molesey would increase this volume by nearly 50 per cent.; and yet they would thus only provide for the immediate future. The great problem that lay before the Board—and it was one of the first importance and urgency—was the economical and efficient provision of works to satisfy the future needs of the Metropolis, and to secure a continuance of the excellent supply of water which it at present enjoyed. He commended this question to the earnest and careful attention of the new Board. Ten times the amount of work in connection with the examination of water was now carried on as compared with that undertaken by the Companies; and it was not too much to say there was no city in the world where the drinking water was subjected to such vigorous analysis as in London. With regard to the Board's Charges Bill, it would be out of place for him then to make any comment on the scheme, which was now under the consideration of a Parliamentary Committee. But of this he was sure—that Parliament would recognize the great pains which had been taken in the preparation of the scheme, and the earnest desire which actuated the Board to formulate such a scale as, in their opinion, would be the fairest to all parties. The unification scheme, however, was not the only matter with which the Appeal and Assessment Committee had been concerned during their term of office. They had dealt with matters relating to the assessment of the Board's property both to Imperial and local rates and taxes; and when he mentioned that the rateable value of the undertaking was £1,160,781, the members would realize that this was a matter of no small importance. The official staff numbered 732, as compared with 599 at the "appointed day" (June 24, 1904); while the employees now numbered 3153, against 2907 at the time of the transfer. These figures illustrated the importance and magnitude of the problems with which the General Purposes Committee were called upon to deal. After expressing the Board's appreciation of the services rendered by the whole of the officials, Sir Melvill alluded, in conclusion, to the position of the Chairman of the Board, who should, he said, be in the closest touch with all branches of the undertaking, and be able to take a bird's-eye view of the entire field of work. This function of the Chairman, though not capable, perhaps, of being expressed in a standing order or a formal resolution, should be recognized by the Board. He saw no other way of securing a continuous and harmonious policy than through the medium of the Chairman and Vice-Chairman, acting in close concert with the Chairmen of Committees.

The Board then proceeded with the ordinary business of the meeting, at the close of which hearty votes of thanks were accorded to the Chairman, the Vice-Chairman, and the officials. Sir Melvill Beachcroft and Mr. W. B. Bryan (the Chief Engineer) acknowledged the compliment.

Water Supply of London in April.—At the meeting of the Metropolitan Water Board on Friday (the last meeting of the present Board), the Works and Stores Committee presented, in the usual tabular form, the following particulars in regard to the supply of water to the Metropolis last month. Average daily supply, 209,031,000 gallons; number of houses supplied, 1,062,938; estimated population, 6,902,515; mean supply per head per day, 30·2 gallons; water in store in impounding reservoirs, 8303 million gallons, compared with 7119 million gallons in April, 1906; number of new supplies, 1539; length of main laid, 19,208 yards.

Bulawayo Water Company, Limited.—According to the report of the Directors of this Company, the gross profit from the sale of water and electric current during the year 1906 amounted to £2869 and £4814 respectively; showing a decrease of £567 on the sale of water and an increase of £261 on the sale of electric current. The profit and loss account for the year, after writing off £4113 for depreciation and £1000 on account of expenses of the debenture issue, and allowing for a sum of £2165 for the costs in an action with the Municipality, shows a debit balance of £3782.

BIRMINGHAM WATER UNDERTAKING.

The report and balance-sheet of the Birmingham Corporation Water-Works show an increase in water-rents for the year ending March 31 of £7084, being 2·55 per cent. over the total for the previous year, against an increase of 3·54 per cent. in the last accounts. The domestic rental has increased to the extent of 2·41 per cent., against 2·67 per cent. in the previous year. The measured supplies for trade and general purposes have increased 3·38 per cent., against 6·44 per cent. last year, and 3·43 per cent. two years ago. The revenue account, notwithstanding the exceptional charge of £6274 for the repair of the Erdlington reservoir, shows a gross profit of £192,018; being an increase of £2073 over the corresponding figure for last year. The charges on account of capital, shown in the profit and loss account, amount to a net total of £276,634, and result in a deficiency for the year of £84,615. This has been covered by: The contribution from the borough fund and rate account, £65,000; transfer, to cover the balance, from capital account, £19,615. As regards the estimate for the coming year, the Committee have requested the Finance Committee to provide from the rates the sum of £65,000, or the same amount as in the account now presented. The average daily distribution of water has been 18,708 million gallons, as against 17,807 millions the previous year; being an increase of 5·06 per cent. The process of clearing up and the disposal of plant in the Elan Valley have proceeded steadily during the winter. Arrangements are now in hand for the erection of the permanent buildings required in connection with the administration of the works. The chief of these is the new school to replace the school at Nantgwillt. The other buildings to be erected at once are a superintendent's house and offices, post office and shop, ten cottages for workpeople, and workshops. The Committee have instructed Mr. H. T. Buckland, the Architect to the Birmingham Education Committee, to act as architect for the new school and other buildings. The rainfall in the water-shed, on the average of the six gauges, was 67·59 inches for the year, as compared with 25·97 inches at Whitacre, and 24·49 inches at Witton. The amount expended on the Elan supply scheme up to March 31, 1907, is £5,726,710.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Arbroath Town Council had several matters relating to the gas undertaking before them last week. The Manager—Mr. A. C. Young—reported that he had ascertained that more favourable terms for gas-stoves could be obtained if the whole business of the Corporation in any particular description of stove were confined to one maker for a period of twelve months, and that he had secured, for the consideration of the Gas Committee, tenders from the several manufacturers supplying stoves to the Corporation, on the footing that the whole business in that class of stove would be given for twelve months to the firm making the most favourable tender. The Manager found that, as regarded packed cookers, the tender of Messrs. Fletcher, Russell, and Co., Limited, of Warrington, was the best value; and that, in the case of small, unpacked cookers, which were in demand by consumers who had not room in their kitchens for a packed cooker, the tender of the Richmond Gas Stove and Meter Company, Limited, was the best. The Gas Committee recommended that the contracts be given to those firms; and the Town Council approved. The contract for meters was let to Messrs. Alder and Mackay, of Edinburgh. A Sub-Committee reported that the tenders for coal having been tabulated, it had been found that the average increases in price were for gas nuts, 3s. a ton; and other varieties, from 3s. 3d. to 3s. 6d. As the tenders showed a very serious increase in the prices over those of the past year, the Gas Committee remitted to the Sub-Committee to endeavour, by negotiation with coalmasters, to obtain some reduction in price, with power to buy, if found advisable, and to report. The Council have raised the price of gas by 2½d. per 1000 feet, as from the last survey, making it 3s. 1½d.

In the Edinburgh Town Council on Wednesday, Mr. A. A. Murray, on behalf of Mr. M'Farlane, called attention to the fact that the illuminating power of the gas on the 17th of May was reported to have been 20·3 candles. This, he said, was just at the very minimum the Gas Commissioners were allowed to supply at. As they all knew, no resolution had been passed to reduce the candle power to anything like so low as 20 candles. Bailie Maxton contended that the Commissioners were acting within their powers.

On Tuesday afternoon a very violent explosion of gas occurred in an electric light culvert at the east end of Union Street, Aberdeen. More accurately, there was one big explosion, followed by several lesser ones. A manhole cover was blown into the air a distance of about 20 feet, and alighted in the middle of the street. A great mass of flame, succeeded by dense smoke, rose from the manhole. The granite pavement was displaced for a distance of 30 feet, where another manhole cover was thrown up; its iron binding being twisted and broken, and there being more flame and smoke. For some time there were repetitions of these. Electric lights, of course, went out, and motors stopped.

The annual meeting of the partners of the Stonehaven Gas Company was held last Monday—Mr. T. Mitchell, sen., in the chair. It was reported that there had been a profit on the year's working of £896, from which 2½ per cent. was deducted, as depreciation, leaving a net profit of £646. Since last year, the Company, in conjunction with the Town Council, had introduced a new system for the lighting and extinguishing of the street-lamps, by means of changing the pressure. The Chairman moved the adoption of the report and the payment of a dividend at the rate of 3s. per share, which was agreed to.

It is reported that Mr. James Hepburn, of Moffat, has invented an apparatus for the lighting and extinguishing of street gas-lamps, operating by means of variations in pressure.

In the main, I suppose, municipalities conduct their business with a considerable amount of common sense; but occasionally we encounter transactions which give rise to a feeling of sympathy with those who have to deal with them. Such a state of matters arose at a meeting of

the Town Council of Duns last week. A letter, it is reported, was submitted from the Secretary of the Duns Gas Company as to the street lighting. The Council had asked the Company to make an offer for the lighting of the town according to certain specifications. The Company replied that they could not see their way to do so; referring, at the same time, to the present price of coal. Bailie Duns proposed that the Clerk be instructed to write and ask for some rebate or discount on paying the town's accounts for the lighting. Bailie Fair thought that if the Gas Company did not see their way to contract for the lighting, they might supply the gas at the same rate as they charge for heating and cooking purposes. If they could supply it at 1s. 6d. per 1000 cubic feet less for heating, he thought they might do the town's lighting cheaper also, seeing they paid nothing for wayleave, or for the breaking up of the streets and paving. After some further discussion, the Clerk was instructed to write to the Company, expressing regret that they could not see their way to contract, and asking whether they would allow a rebate or discount on the account.

Last week, at a meeting of the Town Council of Duns, Bailie Fair expressed his firm conviction that the best thing the Corporation could do, in the matter of water supply, was to make an offer to the Water Company for the purchase of their undertaking. It would be, he considered, a most desirable thing to have the supply in the hands of the town, not so much, perhaps, for the present ratepayers as for those of the future. It was to be hoped that if the Council made an offer of £5500 the Water Company would see their way to accept it. He considered this would be a very fair offer for the works in their present condition. At the present time the water supply was not what it should be. If they purchased the undertaking, there could be little doubt that it would work out so that, in a very few years, they would be getting water at a much reduced rate. The present rate was 1s. 2d. in the pound, and there was no limit to it. If the Company were able to pay 5 per cent. dividend and a bonus, surely it would be better if that were in the hands of the ratepayers than in those of a private Company. He moved that they offer the Company £5500 for the undertaking. Bailie Duns thought they should have a mandate from the ratepayers before they entered upon the question of purchase. In the end, the Council agreed to offer the Company £5500.

CURRENT SALES OF GAS PRODUCTS.

Week ending May 25.

Makers are now largely sold out of products in and around London for this year's delivery. Prices are firmer in most articles; and the demand for all tar oils is large. Ordinary creosote is especially sought after and scarce, and would not now be sold at under 3d. per gallon naked at makers' works. Pitch is firm, and 30s. 6d. net is now asked for this or early next year. The consumption of various qualities of tar for prevention of dust on roads is growing, and may be expected to form an important factor in determining the value of this article. It has been stated that from 100,000 to 150,000 tons may be used this year; and this possible outlet must thus be reckoned with. The recent successful demonstrations on the Staines to Hounslow and other roads in the district, have drawn special notice to the subject just now. 90 per cent. benzol is hardly so firm, and may be called 10d. to 10½d. Crystal carbolic acid is weaker, owing to low quotations on the Continent; the nominal prices there being equivalent to 5½d. and 5⅝d. 60's crude carbolic is 1s. 8d. to 1s. 8½d. Creosote salts and purified naphthalene are both firmer. Sulphate of ammonia has had a distinct rise at all ports, and in London is at least 5s. per ton better. To-day's prices may be called £12 to £12 2s. 6d. on Beckton terms, with a firm tendency.

Sulphate of Ammonia. LIVERPOOL, *May* 25.

The firmer tone in the market noticed in our last report has been sustained; and although the week has been broken by holidays, a fair amount of business has been done, and all ready parcels have been absorbed. The closing quotations are £11 16s. 3d. per ton f.o.b. Hull, and £11 17s. 6d. to £11 18s. 9d. f.o.b. Liverpool and Leith, for prompt delivery; and similar prices are quoted for June. There has been further buying in the forward position at up to £12 per ton for July-December delivery, f.o.b. Leith; and, it is reported, at £12 2s. 6d. per ton for January-April, 1908. At the close, makers are asking for a further advance for delivery over the spring months.

Nitrate of Soda.

Supplies being plentiful on spot, the market is rather weak at 10s. 7½d. per cwt. for ordinary, and 10s. 10½d. for refined quality.

Tar Products. LONDON, *May* 25.

There has been little doing during the past week; many of the works having been partially closed down for the holidays. Pitch remains in about the same position. Manufacturers who wish to sell for prompt delivery have to take low prices; but for forward, there is a firmer tone. Makers do not appear to be at all anxious to sell, and are at present asking figures which are above the ideas of dealers. Creosote is still very firm. In London, business has been done at 2⅝d.; while in the Midlands, this figure is reported to have been refused—manufacturers holding out for 2¾d. In the North, 2¼d. is reported to have been freely paid, both in the Yorkshire and Lancashire districts. Carbolic acid appears to be slightly firmer, though the Continental consumers have not raised their figures; and the English buyers do not seem to be at all anxious to cover in their requirements. A fair amount of business has, however, been done on the part of dealers covering themselves for quantities sold speculatively some time ago. The market is quite unaltered in crystals. Benzol, 90 per cent., is still quiet, and very low figures have been accepted in the North; while it is probable that London manufacturers would consider a reasonable offer for delivery to the end of the year. Toluol is quiet, and in no demand. Solvent naphtha is fairly steady; and in London there seems to be quite as much inquiry as the manufacturers care to cope with. Anthracene and naphthalene have not changed; first-class dealers remaining in about the same position.

SEASON 1907.

The "MAIN"

Gas

Cookers

FOR SLOT INSTALLATIONS.

R. & A. MAIN, LIMITED,

LONDON, GLASGOW, AND FALKIRK.

ALSO AT

BIRMINGHAM, BRISTOL, MANCHESTER, MELBOURNE, AND SYDNEY.

The average values during the week were: Tar, 15s. to 19s. Pitch, London, 26s. ; east coast, 25s. 3d. to 25s. 9d.; west coast, 24s. 6d. to 25s. Benzol, 90 per cent., 8½d. to 10d.; 50-90 per cent., 9½d. to 10½d. Toluol, 1s. 1d. to 1s. 1½d. Crude naphtha, 4¾d.; solvent naphtha, 1s. 2d. to 1s. 3½d.; heavy naphtha, 1s. 2d. to 1s. 3½d. Creosote, London, 2⅝d. to 2¾d.; North, 2 3/16d. to 2 5/16d. Heavy oils, 2⅝d. to 3d. Carbolic acid, 60 per cent., 1s. 7¾d. to 1s. 8¼d. Naphthalene, £6 10s. to £10 10s.; salts, 35s. to 40s. Anthracene, "A" quality, 1½d. to 1¾d.

Sulphate of Ammonia.

This article has been steadily improving throughout the week. The principal London Gas Companies now quote £12 to £12 2s. 6d., and appear to be fairly independent of the market. In London, makers are reported to have done business at £11 12s. 6d., Beckton terms, a decided improvement on the prices last realized. In Liverpool, the market still remains good, and from £11 15s. to £11 17s. 6d. has been paid, according to the quality and the period of delivery. Hull is quiet; but £11 13s. 9d. to £11 15s. is about the ruling value. In Leith, £11 17s. 6d. has been paid and refused for prompt delivery, and £12 for forward. This was at the beginning of the week. Since this, it is reported that £12 has been paid for prompt, and £12 2s. 6d. for forward, though it was not possible to get any absolute confirmation of these figures.

COAL TRADE REPORTS.

Lancashire Coal Trade.

During the past week, most of the coal pits in Lancashire have been closed for the Whitsuntide holidays. Many of the engineering firms and cotton mills have also been silent; so that the lull in coal production or requirement has been general. The very cold and cheerless weather prevailing has rendered house fires necessary, and in this department coal merchants have realized some reduction in stocks. There is no change to report in prices.

Northern Coal Trade.

There is now a normal output of coal; the holiday interruption being overcome, and the supplies and the shipments about as usual. The demand is good; and prices on the whole do not show very much alteration from those quoted last week. In the steam coal trade, best Northumbrians are about 15s. per ton f.o.b.; second-class steams are 14s. to 14s. 6d.; and steam smalls are firm at 10s. to 10s. 3d. There have been more contracts for steam coals for export placed; and it seems probable that the demand will be a steady one for some time to come. In gas coals, the inquiry is fair for the season. Good Durham descriptions vary from about 12s. 9d. to 13s. 6d. per ton f.o.b.; but both higher and lower prices have been quoted in special cases. The large contracts previously referred to may now be looked upon as substantially settled; and while the variation in the prices is known with the quality, it may be believed that the average advance on last year's figures will be much about that stated in this report a week ago, so that there will be a heavy increase in the cost of the coal for the local gas supply, though it will be in some degree minimized by the increased receipts from residuals that are looked on as certain. In the coke trade, the market is steady; and good gas coke is from 13s. to 13s. 3d. per ton f.o.b.

Scotch Coal Trade.

Trade was quiet last week, the demand for shipping being again a disappointment to coalowners. There was very good business for home consumption. The prices quoted were: Ell 12s. to 13s. 6d. per ton f.o.b. Glasgow, splint 13s. to 13s. 3d., steam 11s. 9d. to 12s. The shipments for the week amounted to 273,351 tons—a decrease of 27,412 tons upon the preceding week, and of 10,599 tons upon the corresponding week of last year. For the year to date, the total shipments have been 5,120,571 tons—an increase of 122,759 tons upon the corresponding period of 1906.

Workmen's Compensation Act, 1906.—The Local Government Board have issued circulars to County, Town, and District Councils, the Metropolitan Borough Councils, and Boards of Guardians, drawing attention to the Workmen's Compensation Act, 1906, which will come into operation on the 1st of July. Having regard to sections 1 (1) and 13 of the Act, the Board consider that local authorities generally will be employers within the meaning of the Act, and that to the extent to which in that capacity they will become subject to liability which may be met by insurance, they may properly incur reasonable expenditure in effecting an insurance against their liability under the Act. The Board are not in a position to indicate the range of the possible liabilities of a local authority under the Act. They can only suggest that the authority should carefully consider, in relation to each person in their employ, the effect of the definition of "workman" in the Act, and of the provisions in the first schedule determining what should be regarded as the remuneration of a workman for the purposes of the Act.

South African Lighting Association, Limited.—In the report to be presented by the Directors at the ordinary general meeting next Thursday, they state that during the past year the Association has had to face a continuance of the severe depression in trade referred to in the previous report, and in addition, at Port Elizabeth, the competition of the electric light. The number of new consumers has, however, been greater than in any previous year; the use of gas for cooking and heating has been considerably extended; and the sale at both Port Elizabeth and Grahamstown, in the aggregate, has been maintained—a result largely due to the unremitting efforts of the staff. The balance on the profit and loss account, including that brought forward, after payment of debenture interest and income-tax, is £12,613. An interim dividend was paid in October last of 4 per cent., amounting to £3200, and the Directors have placed to reserve £1500—leaving available a sum of £7913. The Directors now recommend a final distribution of 6 per cent. (making 10 per cent. for the year), free of income-tax, which will absorb £4800. After applying £500 towards the depreciation of investments, there will be left to be carried forward a balance of £2613.

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Imperial Continental Gas Association.

In their column of "City Notes" last Thursday, the "Pall Mall Gazette" had the following: One of the cheapest and most promising investments offering at present is Imperial Continental Gas Stock, writes a sound market observer. It is now down to 171½, and yields £4 13s. The reason for the weakness is said to be a recent death of a wealthy man which has brought large holdings to market. No balance-sheet is published; but a stockholder can see it at the Company's office. A copy of their last one shows that they put about £200,000 out of revenue into works. After doing this, they showed 9½ per cent., but paid 8 per cent. They have reserves of over £2,000,000—not allowing for £1,000,000 which they took out of the reserve last year and distributed in the way of stock to the proprietors. Their capital amounts to £4,940,000; while the only prior charge is £473,000 of 3½ per cent. debenture stock. The Company light thirty cities and towns scattered all over Europe. They have land which they value at £495,000 situated in Antwerp, Berlin, and other places, and bought many years ago. This land has improved more than 200 per cent.

Good Showing at Cockermouth.

The balance-sheet of the Cockermouth Urban District Council Gas-Works shows a gross profit on the past year's working of £1223. Deducting from this £531 interest on loans and £459 the amount of debt repaid, there remains a net balance of £233 which increases the working balance from £2534 to £2767. The Gas Manager (Mr. A. F. Young) states that the works have attained to a condition of perfection; and as far as he is able to gather, they are in a better state than has ever before been the case. He adds that the actual increase in the sales by meter is 168,500 cubic feet. The make of gas per ton of coal carbonized shows an increase of 656 cubic feet for the year, and now stands at 10,301 cubic feet. Customers have increased by 45. In moving the confirmation of the minutes when submitted to the Council, Mr. J. Fleming said he was glad that they had had such a successful year. They used to be told that the gas-works would be a "white elephant." How far this prophecy had turned out to be incorrect, was shown by the year's report. From 1895 to 1898, there was nothing added to the reserve fund; but now they were pursuing a prudent policy. The sulphate plant was not working well yet; but they hoped for better results shortly. Mr. W. H. Youdale, in seconding, said they had every reason to flatter themselves on the very good working of the gas undertaking. The leakage, &c., had come down to 5½ per cent. If they were to float the works as a limited liability concern, with gas at the present price, they would be able to pay 10 per cent. During the past year they reduced the price of gas from 3s. 3d. to 2s. 11d. per 1000 cubic feet, which was a big drop. The works were in splendid condition. The motion was carried unanimously.

Heywood and Middleton Water Board.—The annual report of the Heywood and Middleton Water Board states that the total expenditure on the Ashworth Moor reservoir to the end of the year amounted to £202,174. There are 14,341 consumers in the district; and 425 others are supplied by meter. After meeting all charges, there was a deficiency for the year of £1895, as against £2403 for 1906, and £3345 for 1905. Mr. James Diggle, the Engineer, reports that there is now 52 feet of water in Ashworth Moor reservoir, out of a maximum depth of 63 feet, and that so far the new works have proved satisfactory.

Belfast and the Lighting of Whiteabbey.—As the result of a Local Government Board inquiry, and some subsequent correspondence, with regard to a proposal of the Belfast Rural District Council to secure the powers of an Urban Sanitary Authority for the purpose of the public lighting of Whiteabbey and a portion of Jordanstown, the Board (after admitting the necessity for the lighting) state that they do not consider that section 2 of the Public Health (Ireland) Act, 1896, would enable the Rural District Council to contract with the Corporation of Belfast for a supply of gas within the rural district. They add that the public lamps mentioned in section 24 of the Gas-Works Clauses Act, 1871, must be within the limits of supply of the gas undertakers—in this case the Corporation of Belfast. The Council will further consider the matter.

Free Fittings at Swadlincote.—At the last meeting of the Swadlincote Urban District Council, an estimate prepared by the Gas Engineer (Mr. G. B. Smedley) for a loan of £3000 to be applied in the purchase of free fittings and the extension of mains, gave rise to some discussion. Mr. W. Belfitt, the Chairman of the Lighting Committee, in moving the adoption of the report, said though the cost of providing free fittings in each house amounted to £2 15s., the figures proved that of 188 houses supplied the consumption by each householder averaged £1 7s. 8d. for the year. The income arising from the free fittings came to nearly £700; and 1100 applicants were asking for slot meters. Altogether there were 5000 houses in the district, and only 2000 of them were supplied with gas. He had advised the Committee to ask for sanction to the borrowing of £5000; and he was pleased they had agreed to recommend the sum of £3000. Of this amount, £1300 had been spent. The report was adopted.

Price of Gas in New York.—Readers may remember that a dispute has been going on for some time in New York as to the price to be paid for gas. An Act was passed fixing the figure at 80 c. per 1000 cubic feet; but the Companies refused to be bound by it. The matter was submitted to a Referee (Mr. A. H. Masten), who is now engaged in considering the mass of evidence brought before him and the arguments of Counsel for the respective parties. Meanwhile, the charge of $1 is being levied, and the 20 c. in excess of the legal figure deposited in three New York banks at 2½ per cent. interest. Up to the end of April, the sum so deposited by the various Companies amounted to $3,591,376. About 500,000 names and bills sent to consumers have been received. Even after the Referee gives his decision, the matter will have to come before the Courts; and it is considered that it will not be till about this time next year that the consumers will know whether they will have to pay in future 80 c. or $1 per 1000 cubic feet for their gas. The position is an extraordinary one.

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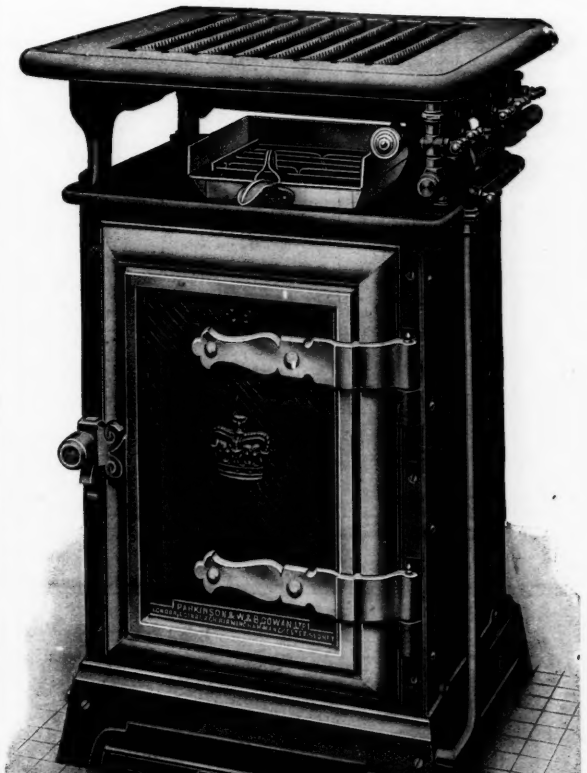

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Suffocation by Gas.—Owing to an escape of gas last Friday morning at Louisa Street, Hoxton, a Mrs. Choke was killed and several persons were rendered ill. It appears that during the previous few days a steam-roller had been at work on the road; and it is presumed that its weight caused the gas-main to crack and allow an escape of gas, which entered the basements of two houses. At about half-past eight, when Mr. Butcher, the occupant of one, returned home, his wife and children complained of sickness. Detecting a strong smell of gas, he opened the windows and called for assistance. Mrs. Butcher and her five children were removed to a hospital A married woman named Wilmore and her son, together with Mrs. Choke, also lived in the same house, and when an entrance was effected to their rooms, Mrs. Choke was found to be dead. Mrs. Wilmore was unconscious, and, with her son, was taken to the hospital. The occupants of the next house were also found in a dangerous condition, and were removed. After treatment, all except Arthur Wilmore, Mrs. Wilmore, Mrs. Lawrence, and her daughter, who were sta'ed to be in a precarious condition, were discharged.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 572.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
500,000	10	Apl 11	10½	Alliance & Dublin 10 p.c.	20–21	..	5 0 0
268,324	10	,,	7½	Do. 7 p.c.	13¼–14½	–⅛	5 3 5
200,000	5	May '5	7	Bombay, Ltd.. . .	6½–7*	..	5 0 0
40,000	5	,,	7	Do. New, £4 paid	4⅝–5⅛*	..	5 6 8
50,000	10	Feb. 28	14	Bourne- mouth Gas and Water Co. 10 p.c. Pref. 6 p.c.	27½–28½	..	4 18 3
51,810	10	,,	7		16½–17	..	4 2 4
53,200	10	,,	6		15–16	..	3 15 0
380,000	Stk.	,,	12½	Brentford Consolidated	245–250	..	5 0 0
300,000	,,	,,	9½	Do. New . . .	190–195	..	4 17 5
50,000	,,	,,	5	Do. 5 p.c. Pref.	117–122	..	4 2 0
206,250	,,	Dec. 13	4	Do. 4 p.c. Deb. .	101–104	..	3 16 11
220,000	Stk.	Mch. 14	11½	Brighton & Hove Orig.	220–225	..	5 0 0
246,320	,,	,,	8½	Do. A. Ord. Stk. .	160–165	..	5 0 0
460,000	20	Apl. 11	10	British	42½–43½	..	4 11 11
104,000	Stk.	Feb. 28	6	Bromley, Ord. 5 p.c.	119–122	..	4 18 4
165,700	,,	,,	4½	Do. do. 3½ p.c.	90–93	..	4 16 9
500,000	10	May 15	7	Buenos Ayres (New) Ltd.	11–11⅛*	..	6 1 9
250,000	Stk.	Dec. 13	4	Do. 4 p.c. Deb. .	95–97	..	4 2 6
150,000	20	Mch. 14	8½	Cagliari, Ltd.	25–27	+1	5 17 10
100,000	10	Sept. 27	10	Cape Town & Dis., Ltd.	12–14	..	7 2 10
100,000	10	Apl. 26	4½	Do. 4½ p.c Pref.. .	8½–9½	..	4 14 9
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	50–52	..	5 15 5
50,000	Stk.	Dec. 28	4½	Do. 4½ p.c. Deb. Stk.	56–98	..	4 11 10
157,150	Stk.	Feb. 28	5	Chester 5 p.c. Ord. . .	109–111	..	4 10 1
1,443,280	Stk	,,	5⅛	Commercial 4 p.c Stk. .	107–110	..	4 14 6
560,000	,,	,,	5	Do. 3½ p.c. do. .	103–106	..	4 14 4
475,000	,,	Dec. 13	3	Do. 3 p.c. Deb. Stk.	83–85	..	3 10 7
800,000	Stk.	,,	6⅜	Continental Union, Ltd.	115–120	–2½	5 8 4
200,000	,,	,,	7	Do. 7 p.c. Pref.	138–143	..	4 17 11
460,170	Stk.	—	5½	Derby Con. Stk. . . .	122–124	..	4 8 9
55,000	,,	Jan.	4	Do. Deb. Stk. . . .	103–105	..	3 16 2
486,090	10	Jan. 31	11	European, Ltd. . . .	24–25	..	4 8 0
354,060	10	,,	11	Do. £7 10s. paid	18–19	..	4 6 10
15,203,110	Stk.	Feb. 14	4⅛	Gas- light and Coke Co. 4 p.c. Ord. . .	92–94	..	4 13 6
2,600,000	,,	,,	3½	3½ p.c. max. . .	87–89	..	3 18 8
3,799,735	,,	,,	4	4 p.c. Con. Pref.	102–105	..	3 16 2
4,193,975	,,	Dec. 13	3	3 p.c. Con. Deb.	83–85	..	3 10 7
258,740	Stk.	Mch. 14	5	Hastings & St. L. 3½ p.c.	95–100	..	5 0 0
82,500	,,	,,	6⅜	Do. do. 5 p.c.	116–119	..	5 9 3
70,000	10	Apl. 26	11	Hongkong & China, Ltd.	15–20	..	5 10 0
4,940,000	Stk.	May 15	8	Imperial Continental .	169–174*	–1	4 12 0
473,600	Stk.	Feb. 14	3½	Do. 3½ p.c. Deb. Red.	93–95	..	3 13 8
184,602	Stk.	Mch. 14	6	Lea Bridge Ord. 5 p.c. .	117–122	..	4 18 4
306,083	,,	Dec. 28	4	L'rpool Unit'd Deb. Stk.	110–112	..	3 11 5
561,000	Stk.	Feb. 28	10	Liverpool United A . .	223–225	..	4 8 11
718,100	,,	,,	7	Do. B . .	164–165	..	4 4 10
144,140	Stk.	Feb. 14	7⅞	Maidstone 5 p.c. . . .	142–147	..	5 3 8
75,000	5	Nov. 29	5	Malta & Medn., Ltd. .	4¼–4⅜	..	5 5 3
560,000	100	Apl. 2	5	Met. of 5 p.c. Deb..	100–102	..	4 18 0
250,000	100	,,	4½	Melbourne 4½ p.c. Deb.	00–102	..	4 8 3
541,920	20	Nov. 14	3½	Monte Video, Ltd. . .	11½–12½	..	5 12 0
1,775,892	Stk.	Feb. 28	4⅜	Newc'tle & G'tesh'd Con.	105–107	–½	4 6 5
406,025	Stk.	Dec. 28	3½	Do. 3½ p.c. Deb.	96–97	..	3 12 2
15,000	10	Feb. 28	10	North Middlesex 10 p.c.	19½–20½	..	4 17 7
55,940	1)	,,	7	Do. 7 p.c.	13–14	..	5 0 0
300,000	Stk.	Apl. 26	8	Oriental, Ltd. . . .	143–148	–5	5 8 1
60,000	5	Mch. 27	7	Ottoman, Ltd. . . .	6–6⅛	..	5 7 8
398,490	5	May 15	7	Primitiva Ord. . . .	6⅝–7⅛*	..	4 16 7
796,980	5	Jan. 31	5	Do. 5 p.c. Pref.	5–5⅛	..	4 15 3
488,900	100	Dec. 1	4	Do. 4 p.c. Deb. .	95–97	..	4 2 6
1,000,000	10	Apl. 26	8	River Plate Ord. . . .	12⅞–13¼	..	6 0 9
312,650	Stk.	Dec. 28	4	Do. 4 p.c. Deb. .	95–97	..	4 2 6
250,000	10	Mch. 27	8	San Paulo, Ltd. . . .	12½–13	..	6 3 1
125,000	50	Jan. 2	5	Do. 5 p.c. Deb. .	48–50	..	5 0 0
135,000	Stk.	Mch. 14	10	Sheffield A	245–247	..	4 1 0
209,984	,,	,,	10	Do. B	245–247	..	4 1 0
523,500	,,	,,	10	Do. C	245–247	..	4 1 0
70,000	10	Oct. 26	10	South African	15⅛–10⅛	..	6 1 3
6,350,000	Stk.	Feb. 14	5⅜	South Met., 4 p.c. Ord.	122–124	+1	4 8 9
1,895,445	,,	Jan. 16	3	Do. 3 p.c. Deb.	83–85	..	3 10 7
201,720	Stk	Mch. 14	8	South Shields Con. Stk.	157–159	–1	5 0 8
605,000	Stk.	Feb. 28	5⅜	S'th Suburb'n Ord. 5 p.c.	120–123	..	4 9 5
60,000	,,	,,	5	Do. 5 p.c. Pref. . .	120–123	..	4 1 4
117,058	,,	Jan. 16	5	Do. 5 p.c. Deb. Stk.	125 –130	..	3 16 11
502,310	Stk.	May 15	5	Southampton Ord. .	105 –110*	..	4 10 11
120,000	Stk.	Feb. 25	6½	Tottenham 4 5 p.c. and B 3½ p.c.	123 –126	..	5 3 2
398,940	,,	,,	5		101–103	..	4 17 1
137,500	,,	Dec. 28	4	Edmonton 4 p.c. Deb.	101–103	..	3 17 8
182,380	10	,,	8	Tuscan, Ltd. . . .	10⅛–11	..	7 5 6
149,900	10	Jan. 2	5	Do. 5 p.c. Deb. Red	02 –104	..	4 16 2
193,742	Stk.	Feb. 28	5	Tynemouth 5 p.c. max.	105–107	..	4 13 6
30,000	Stk.	Feb. 14	8	Wands- worth and Clapham A 5 p.c. . .	—	..	—
255,636	,,	,,	6⅜	B 3½ p.c. .	133–138	–2	4 14 2
75,000	,,	,,	5⅝	C 3½ p.c. .	—	..	—
79,416	,,	Dec. 28	3	Putney 3 p.c. Deb. Stk.	79–82	..	3 13 2
845,872	,,	Feb. 28	5⅛	West Ham 5 p.c. Ord.	112–105	+1	4 17 7
185,000	,,	,,	5	Do. 5 p.c. Pref. .	120–123	..	4 1 4
228,300	,,	Dec. 28	4	Do. 4 p.c. Deb. Stk.	112–105	..	3 16 2

Prices marked * are "Ex div."

LEAFLETS FOR DISTRIBUTION.

"ILLUMINATING TRUTHS FOR HOUSEHOLDERS." Nos. 1, 2, 3, and 4 NOW READY.

No. 1.—"The Sanitary Aspects of Gas and Electric Lighting."
No. 2.—"The Cleanliness of Illuminants: The Eyesight."
No. 3.—"Fire Risks."
No. 4.—"The Relative Cost of Gas and Electricity, and Matters affecting it."
No. 5.—"On Reliability, with Instances of Misplaced Confidence."
No. 6.—"On Shop Lighting, with Special Reference to the Flame Arc Lamp."

This series of Leaflets will be useful, not only for distribution among Householders generally, but for circulation among Shareholders to fortify them with arguments in defence of the commodity in which they have invested capital. Copies of each Leaflet should also be kept in every Gas Undertaking's Show-Rooms.

Prices for Quantities on Application to WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

ASSISTANT-MANAGER. Ilford Gas Company. Applications by June 4.
TRAVELLING REPRESENTATIVE (GAS-FITTINGS). No. 4777.
TRAVELLING REPRESENTATIVE (GAS-FITTINGS). No. 4776.
CLERK. Hebden Bridge and Mytholmroyd Gas Board. Applications by June 4.
CLERK. Cheltenham Gas Company.

Situations Wanted.

IN LARGE GAS-WORKS. No. 4775.
ENGINEER AND MANAGER OR ASSISTANT. No. 4778.

Plant (Second Hand) for Sale.

GASHOLDER AND TANK. Peebles Gas Works.
STEAM-ENGINES. Hayward Tyler and Co.

Stocks and Shares.

CHIGWELL, LOUGHTON, AND WOODFORD GAS COMPANY. June 18.
COMMERCIAL GAS COMPANY. June 4.
SOUTH ESSEX WATER COMPANY. June 18.
WANDSWORTH AND PUTNEY GAS COMPANY. June 18.
WALKER AND WALLSEND GAS COMPANY. June 14.

TENDERS FOR

Benzol.

HEYWOOD GAS DEPARTMENT. Tenders by June 12.

Coal and Cannel.

ALTRINCHAM GAS COMPANY. Tenders by June 8.
BELPER GAS COMPANY. Tenders by June 7.
DROGHEDA GAS DEPARTMENT. Tenders by June 5.
EASTBOURNE GAS COMPANY. Tenders by June 5.
FENTON GAS DEPARTMENT. Tenders by June 13.
HAVERHILL GAS DEPARTMENT. Tenders by June 8.
HEXHAM GAS COMPANY. Tenders by June 8.
HEYWOOD GAS DEPARTMENT. Tenders by June 12.
LANCASTER GAS DEPARTMENT. Tenders by June 14.
LURGAN GAS COMPANY. Tenders by June 3.
MALVERN GAS DEPARTMENT. Tenders by June 12.
NOTTINGHAM WATER DEPARTMENT. Tenders by June 10.
OXFORD GAS COMPANY. Tenders by June 10.
PAIGNTON GAS COMPANY. Tenders by June 22.
PETERBOROUGH GAS COMPANY. Tenders by June 8.
SALISBURY GAS COMPANY. Tenders by June 12.
SHREWSBURY GAS COMPANY. Tenders by June 13.
STOURBRIDGE GAS DEPARTMENT. Tenders by June 11.
SUTTON-IN-ASHFIELD GAS DEPARTMENT. Tenders by June 4.
SWADLINCOTE GAS DEPARTMENT. Tenders by May 28.
TAUNTON GAS COMPANY. Tenders by June 1.
TIVERTON LIGHTING COMMITTEE. Tenders by June 3.
WALSALL GAS DEPARTMENT. Tenders by June 15.

Coke.

SUTTON-IN-ASHFIELD GAS DEPARTMENT. Tenders by June 4.

Gasholders (Second Hand).

NEWHAVEN GAS COMPANY
GRIFFITH, 46, Queen Victoria Street, E.C.

Fire-Clay Goods.

WOLSTANTON URBAN DISTRICT COUNCIL. Tenders by June 10.

Lime.

SUTTON-IN-ASHFIELD GAS DEPARTMENT. Tenders by June 4.
SWADLINCOTE GAS DEPARTMENT. Tenders by May 28.

Pipes, &c.

NOTTINGHAM WATER DEPARTMENT. Tenders by June 10.

Retort-Bench, &c.

WOLSTANTON URBAN DISTRICT COUNCIL. Tenders by June 10.

Tar and Liquor.

ASHBOURNE GAS COMPANY. Tenders by May 31.
FENTON GAS DEPARTMENT. Tenders by June 13.
STOURBRIDGE GAS DEPARTMENT. Tenders by June 11.
SUTTON-IN-ASHFIELD GAS DEPARTMENT. Tenders by June 4.
SUTTON, REIGATE, AND NEWHAVEN GAS COMPANIES. Tenders by May 30.

Valves, Hydrants, Taps, Lead, and Lead Pipe, &c.

NOTTINGHAM WATER DEPARTMENT. Tenders by June 10.

Messrs. Thomas Glover and Co., Limited, are to carry out for the Middlesex County Council the necessary work in connection with the reverification of the standard test holders at the gas-meter testing-station at Edmonton.

There were thirteen tenders received for the new steel tank and gasholder for the Barnoldswick Gas-Works, advertised in the "JOURNAL" for the 9th ult.; and that of Messrs. C. & W. Walker, Limited, was accepted. The remainder of the work in connection with the site and foundations will be done by local contractors.

The Pneumatic Gas Lighting Company, Limited, of No. 36, Farringdon Street, E.C., have just completed an important installation of their system for the London County Council throughout the building of the Bethnal Green Fire Station. All points are connected to one general switch-board in the officers' quarters. The work was done in conjunction with the Gaslight and Coke Company.

At the Tower Bridge Police Court, on the 16th inst., Alfred Taylor, a lamplighter in the service of the Bermondsey Borough Council, was charged with stealing incandescent mantles, and a licensed victualler with receiving them as well as burners. The accused were remanded. Last Wednesday they were committed for trial, in company with two other lamplighters, previously remanded on a similar charge.

The Bucks and Oxon District Gas and Coke Company, Limited, has been registered with a capital of £25,000, in £10 shares (1250 preference), to carry on, in the counties of Buckingham and Oxford and elsewhere, the business of manufacturers and suppliers of gas, coal and coke merchants, manufacturers of, and dealers in, chemicals, coal tar, and other residual products obtained in the manufacture of gas, &c. There is to be no initial pubic issue.

A Local Government Board inquiry is to be held at Bishop Stortford into an application by the Urban District Council for permisssion to borrow £1000 for the purpose of providing new plant at the water-works.

Messrs. Joseph Taylor and Co., of Bolton, have received an order from Messrs. John Terry and Co. for two of their best and latest makes of solid plate-lead saturators, for shipment to Australia. These saturators are fitted with duplicate ammonia and acid pipes, which were fitted before they were sent away. The firm have also in hand saturators for the Warrington and the Swansea Gas-Works. The total weight of the four saturators referred to is about 20 tons.

The Directors of the North Pembrokeshire Water and Gas Company invite applications for 11,807 shares of £1 each, being the balance of unissued capital, at par. The shares rank for dividend up to 10 per cent. per annum. The amount is required for extensions necessitated by the development of Fishguard and Goodwick, consequent upon the construction of important harbour and other works in connection with the new short route of the Great Western Railway Company to the South of Ireland. It is stated that since the beginning of the year the gas and water rentals have increased.

Some days ago, when three of the Mitcham and Wimbledon Gas Company's employees were engaged laying a new section of an 18-inch gas-main, the bladder fixed at the end of the old main suddenly burst. The men were overcome by the fumes before they could escape from the excavation; but their fellow workmen soon extricated them from their precarious position, and they were not long in reviving. In consequence of the burst, the gas supply to the greater part of Wimbledon and Merton had to be cut off; and for several hours inconvenience was occasioned in a number of laundries and small works.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

TERMS OF SUBSCRIPTION to the "JOURNAL."

United Kingdom: One Year, 21s.; Half Year, 10s. 6d.; Quarter, 6s. 6d.

Payable in advance. If credit is taken, the charge is 25s. a year.

Abroad (in the Postal Union): £1 7s. 6d., payable in advance.

All Communications, Remittances, &c., to be addressed to WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.

Telegrams: "GASKING, LONDON." Telephone: P.O. 1571a Central.

OXIDE OF IRON.

O'NEILL'S OXIDE
For GAS PURIFICATION.
LARGEST SALE OF ANY OXIDE,

SPENT OXIDE PURCHASED IN ANY DISTRICT.

GAS PURIFICATION & CHEMICAL CO., LD.,
PALMERSTON HOUSE,
OLD BROAD STREET, LONDON, E.C.

WINKELMANN'S

"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for GAS-WORKS.
ANDREW STEPHENSON, 182, Palmerston House, Old Broad Street, London, E.C. "Volcanism, London."

BROTHERTON & CO., LIMITED.
Offices: Commercial Buildings, LEEDS.
Correspondence invited.

PATENTS AND TRADE MARKS
PUBLICATIONS, "MERCHANDISE MARKS ACT, and Decisions thereunder," 1s.; "TRADE SECRETS v. PATENTS," 6d.; "DOCTRINE of EQUIVALENTS, Mechanical and Chemical," 6d.; "SUBJECT-MATTER of PATENTS," 6d.
MEWBURN, ELLIS, & PRYOR, Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C. Telegrams: "Patent London." Telephone: No. 243 Holborn.

"NUGEPE" GAS PLANT CEMENT.

JOHN E. WILLIAMS AND CO.,
LOWER MOSS LANE,
MANCHESTER, S.W.
For all Joints in connection with Oil-Gas Plant and Sulphate Plant.
For all Gas Joints.
For all Tar Joints.
For all Ammonia Joints.

INCREASE YOUR MAKE.

SEND for Particulars of the "RAPID" Carburettor. Why be short of Gas when you can stretch the make from 1000 to 2000 cubic feet per ton, without any difficulty?
BIGGS, WALL, & Co., 13, Cross Street, Finsbury Pavement, LONDON.

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM, and 54 & 47, Westminster Bridge Road, LONDON, S.E.
WET AND DRY GAS-METERS, PREPAYMENT METERS, STATION METERS, AND GOVERNORS.
REPAIRS RECEIVE PROMPT ATTENTION.
Telephones: 254 Oldham, and 2412 HOP, London.
Telegrams:—
"BRADDOCK, OLDHAM," and "METRIQUE, LONDON."

BENZOL
AND
CARBURINE FOR GAS ENRICHING.
ALSO
THE MAXIM PATENT CARBURETTOR.

For Prices, &c., apply to
THE GAS LIGHTING IMPROVEMENT CO., LTD.,
7, BISHOPSGATE STREET WITHOUT,
LONDON, E.C.
Telegraphic Address: "Carburine, London."

SULPHURIC ACID for Sale, specially suitable for making Sulphate of Ammonia.
BROTHERTON AND CO., LTD., Chemical Manufacturers.
Works: BIRMINGHAM, LEEDS, WAKEFIELD, and SUNDERLAND.

SULPHURIC ACID.

SPECIALLY prepared for the Manufacture of SULPHATE OF AMMONIA.
SPENCER CHAPMAN & MESSEL, LTD.
with which is amalgamated WM. PEARCE & SONS, LTD.
36, Mark Lane, LONDON, E.C. Works: SILVERTOWN.
Telegrams: "HYDROCHLORIC, LONDON."
Telephone: 341, AVENUE.

TEMPERLEY TRANSPORTERS
FOR Rapid and Economical Handling of Coal and Coke in Gas-Works.
Next Illustrated advt. will appear on June 18.
TEMPERLEY TRANSPORTER COMPANY,
72, BISHOPSGATE STREET WITHIN, LONDON, E.C.
Telephone: 365 LONDON WALL. Telegrams: "TRANSUMO."

OXIDE OF IRON.
(NATURAL.)
SPENT OXIDE PURCHASED.
BALE'S FIRE CEMENT.
PAINT FOR GAS-WORKS

BALE & CHURCH,
5, CROOKED LANE, LONDON, E.C.

AMMONIACAL Liquor wanted.
BROTHERTON AND CO., LTD., Ammonia Distillers.
Works: BIRMINGHAM, GLASGOW, LEEDS, LIVERPOOL, WAKEFIELD, AND SUNDERLAND.

BRISTOL RECORDING GAUGES AND THERMOMETERS.

J. W. & C. J. PHILLIPS, 23, COLLEGE HILL, LONDON, E.C., and 7, Park Square, LEEDS.

GAS TAR wanted.
BROTHERTON AND CO., LTD., Tar Distillers.
Works: BIRMINGHAM, GLASGOW, LEEDS, LIVERPOOL, WAKEFIELD, AND SUNDERLAND.

SULPHATE OF AMMONIA
SATURATORS and all LEAD and TIMBER WORK in Connection with Sulphate Plants.
We guarantee promptness, with efficiency for Repairs.
JOSEPH TAYLOR AND CO., CENTRAL PLUMBING WORKS BOLTON.
Telegrams: SATURATORS, BOLTON. Telephone 0848.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
J. F. BLAKELEY, Gas Engineer, Thornhill, DEWSBURY.

GAZINE—A radical Solvent and Preventative of Naphthalene deposits, and the Automatic cleaning of Mains and Services.
It is also used for the Enrichment of Gas, and has an illuminating value double that of 90 per cent. Benzol.
Supplied by C. BOURNE, West Moor Chemical Works, KILLINGWORTH, or through his Agent, F. J. NICOL, Pilgrim Street Chambers, NEWCASTLE-ON-TYNE.
Telegrams: "DORIC," Newcastle-on-Tyne. National Telephone No. 2497.

ROBERT DEMPSTER & SONS, Ltd., Contractors for Complete CARBONIZING PLANTS and every description of GAS APPARATUS and ELEVATING and CONVEYING PLANT, ROSE MOUNT IRON-WORKS, ELLAND.

JOHN RILEY & SONS, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of Special SULPHURIC ACID, for Sulphate of Ammonia Making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol, which has now been used for upwards of 50 Years. References given to Gas Companies.

GAS OILS.

MEADE-KING, ROBINSON, & CO. Represent the Strongest Independent Refineries in America; also Petroleum Spirit for Gas Enrichment. 18, EXCHANGE STREET, MANCHESTER, and 11, OLD HALL STREET, LIVERPOOL.

HYDRATED OXIDE OF IRON.

PREPARED from Pure Iron.
Twice as Rich as Bog Ore.
Gives no Back Pressure.
The Cheapest in the Market.
Can be Exchanged for Spent Oxide.
READ HOLLIDAY AND SONS, LTD., HUDDERSFIELD.

SITUATION required by a Young Man. Eleven Years' Experience in large Gas-Works, Constructional Department. Good Technical Education. Excellent References.
Address No. 4775, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

QUALIFIED Gas Engineer seeks Appointment as ENGINEER and MANAGER in a medium-sized Works, or ASSISTANT at large Works. Double Silver Medallist. Eleven Years' Experience. First-Class References.
Address No. 4778, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

CHELTENHAM GAS COMPANY.

WANTED, a Clerk in the Works Office. Experience in Gas-Fittings Business. Commencing Salary 35s. per week.
Applications to R. O. PATERSON.
May 25, 1907.

WANTED, a First-Class Travelling REPRESENTATIVE with good Connection in Scotland Gas-Fittings Trade. Salary and Commission.
Apply, by letter, giving full Particulars of previous Appointments and References, to No. 4777, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a First-Class Travelling REPRESENTATIVE with good Connection in North of England Gas-Fittings Trade.
Apply, by letter, giving full Particulars of previous Appointments and References, and stating Salary required, to No. 4776, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

HEBDEN BRIDGE AND MYTHOLMROYD GAS BOARD.

WANTED, a Competent Clerk in a Gas Office. Commencing Salary 25s. per week.
List of Duties and Forms of Application may be had from the undersigned, to whom Applications must be made not later than the 4th day of June, 1907.
R. CRABTREE,
Clerk to the Board.
Market Street,
Hebden Bridge.

ILFORD GAS COMPANY.

AN Assistant-Manager Wanted by the above Company for their Works making 300 Millions per Annum.
Candidates must possess a thorough knowledge of Gas Manufacture, Inclined Retorts, Regenerative Settings, the Manufacture of Water Gas and Sulphate of Ammonia. Drawing Office and Laboratory Experience also essential.
Applications, enclosing *copies* of Testimonials, and stating Age and Salary required, endorsed "Assistant-Manager," to be sent in by the 4th of June, 1907, addressed to the SECRETARY, Ilford Gas Company, ILFORD.
May 23, 1907.

WANTED for a small Country Gas-Works, a Second-Hand GASHOLDER, 40 feet diameter and 16 feet deep.
Apply to A. L. GRIFFITH, 46, Queen Victoria Street, LONDON, E.C.

THE Directors of the Newhaven (Sussex) Gas Company are prepared to consider OFFERS of a Second-Hand GASHOLDER, with Counterbalance Weights, of about 35,000 cubic feet capacity, with STEEL TANK. Both Holder and Tank to be Erected and left in Proper Working Condition at Newhaven (Sussex) and to the satisfaction of the Company's Engineer.
Address GEO. MEAD-ROBINS, Gas Offices, Sutton, SURREY.

STEAM-ENGINES FOR SALE.

REMOVED FOR ELECTRIC DRIVING.

ONE 8-inch by 16-inch, One 10-inch by 18-inch, One 12-inch by 24-inch, One Pair Coupled 14½-inch by 24-inch. All Fitted with Rider's Variable Expansion.
Apply to Messrs. HAYWARD TYLER AND COMPANY, LIMITED, 99, Queen Victoria Street, LONDON, E.C.

GASHOLDER for Sale, Second-Hand. Cast-Iron TANK, 45 ft. diameter by 16 ft. 6 in. deep. Working capacity of Holder, 24,000 cubic feet.
Apply to the MANAGER, Gas-Works, PEEBLES.

CLAY RETORTS—30 New Retorts, 18 by 15 ○'s and 22 by 14 ○'s. Will accept 3s per foot for immediate Sale. New and Perfect.
Apply to FIRTH BLAKELEY COMPANY, Thornhill, DEWSBURY.

EXCEPTIONAL Bargain. 50 feet Double-Lift GASHOLDER, 60,000 feet capacity. Must be cleared by June. Splendid Bargain. Equal to new. Sacrificed and Re-erected at Nominal Sum for Immediate Sale.
Apply to FIRTH BLAKELEY COMPANY, Thornhill, DEWSBURY.

GAS-WORKS PLANT for Sale—
NEW SINGLE GASHOLDER, 30,000 ft. capacity.
" " 15,000 "
" " 5,000 "
GASHOLDERS of varying capacities from 1000 feet to 10,000 feet.
WATER-GAS PLANT for 150,000 feet per day.
GAS-ENGINES, PUMPS, EXHAUSTERS, PURIFIERS, and Sundries.
Inquiries Solicited, Specially Low Prices will be quoted for prompt Sale, either with or without Fixing.
Apply to WRIGHTS GAS PLANT OFFICE, 181, QUEEN VICTORIA STREET, E.C.

OXFORD GASLIGHT AND COKE COMPANY.

THE Directors invite Tenders for the Supply of about 37,000 Tons of Best Screened COAL or Washed NUTS, to be delivered to their Siding (Great Western Railway), during the Year ending June 30, 1908.
Tenders, addressed to the Chairman, Oxford Gaslight and Coke Company, and endorsed "Tender for Coal," to be delivered by June 10, 1907.
By order,
JAMES ELDRIDGE,
Engineer and Manager.

URBAN DISTRICT COUNCIL OF STOURBRIDGE.
(GAS DEPARTMENT.)

THE Gas Committee invite Tenders for the Purchase of their Surplus TAR during the Twelve Months ending June 30, 1908.
Tenders, on our own Tender Form, endorsed "Tar," and addressed to the Chairman of the Gas Committee, to be sent to me on or before Tuesday, June 11, 1907.
The Contract will contain a Fair Wages, &c., Clause.
The highest or any Tender not necessarily accepted.
By order of the Committee,
CHARLES H. WEBB,
Engineer and Manager.
Gas-Works, Stourbridge,
May 24, 1907

URBAN DISTRICT COUNCIL OF STOURBRIDGE.
(GAS DEPARTMENT.)

THE Gas Committee invite Tenders for the Supply of about 19,000 Tons of good Screened GAS COAL, delivered on their Gas-Works.
Forms of Tender may be had on application to the undersigned, and only Offers on our own Form will be considered.
Tenders, endorsed "Gas Coal," addressed to the Chairman of the Gas Committee, to be sent to me at the Gas-Works, Stourbridge, on or before Tuesday, June 11, 1907.
The Contract will contain a Fair Wages, &c., Clause.
The lowest or any Tender not necessarily accepted.
By order of the Committee.
CHARLES H. WEBB,
Engineer and Manager.
Gas-Works, Stourbridge,
May 24, 1907.

FENTON URBAN DISTRICT COUNCIL.

TAR AND AMMONIACAL LIQUOR.

THE Gas Committee of the above Council invite TENDERS for the Purchase of the Surplus TAR and AMMONIACAL LIQUOR made at their Works during the Twelve Months commencing the 1st day of July next.
Sealed Tenders to be sent in not later than Thursday, the 13th of June, 1907, addressed to the Chairman, Gas-Works, Fenton, Staffordshire, and endorsed "Tender for Tar, &c."
The Committee reserve to themselves the right of accepting any Tender for the Tar or Liquor separately.
The Committee do not bind themselves to accept the highest or any Tender.
Further Particulars may be obtained on application to the undersigned.
ROBERT SURTEES,
Engineer and Manager.
Gas-Works, Fenton, Staffs.,
May 24, 1907.

FENTON URBAN DISTRICT COUNCIL.

TENDERS FOR GAS COAL.

THE Gas Committee of the above Council invite TENDERS for the Supply and Delivery of about 8000 Tons of GAS COAL, BURGY, NUTS, or BEANS for the Twelve Months commencing the 1st of July next.
Specification and Form of Tender may be obtained on Application to the undersigned.
Sealed Tenders, endorsed "Coal," to be forwarded to the Chairman, Gas-Works, Fenton, Staffs., not later than Thursday, the 13th of June, 1907.
The lowest or any Tender not necessarily accepted.
ROBERT SURTEES,
Engineer and Manager.
Gas-Works, Fenton, Staffs.,
May 24, 1907.

COAL.

THE Salisbury Gas and Coke Company invite TENDERS for 1000 to 3000 Tons of GAS COAL delivered f.o.r. Salisbury, as required over the next Twelve Months.
Tenders, on Sender's Forms, before June 12, addressed to Mr. N. H. HUMPHRYS, Gas-Works, SALISBURY.

EASTBOURNE GAS COMPANY.

THE Directors invite Tenders for the Supply of Ten Thousand (10,000) Tons of GAS COAL, to be delivered at Eastbourne Railway Station during the Twelve Months next ensuing from Sept. 1 next, in equal monthly quantities.
Forms of Tender of the undersigned, which must be returned, addressed to the Chairman, not later than the 5th of June.
JAMES S. GARRARD,
Secretary.
May 24, 1907.

HEXHAM GAS COMPANY.

TENDERS FOR COAL.

THE Directors of the above Company are prepared to receive TENDERS for about 5000 Tons of Unscreened GAS COAL, to be delivered as required at Hexham Station or at the Company's Works during the Year ending June 30, 1908.
Tenders, specifying place of delivery and name of pit from which the Coal is raised, to be forwarded to the undersigned not later than the 8th of June, 1907.
HERBERT LEES,
Engineer and Secretary.
Gas Office, Hexham,
May 22, 1907.

CORPORATION OF LANCASTER.
(GAS DEPARTMENT.)

TENDERS FOR GAS COAL.

THE Gas Committee are prepared to receive TENDERS for the Supply of GAS COAL, NUTS, and Rough GAS SLACK, to be delivered on the Gas-Works Siding, Lancaster, in such quantities, and at such times, as may be required during a period of Twelve Months, commencing delivery Aug. 1 next.
Sealed Tenders, endorsed "Gas Coal," giving full Particulars of the Coal offered, must be delivered to T. C. Hughes, Esq., Town Clerk, Lancaster, not later than June 14 next.
Any further Information and Forms of Tender may be obtained on application to the undersigned.
C. ARMITAGE,
Manager.
Gas-Works, Lancaster.

MALVERN URBAN DISTRICT COUNCIL.

THE Gas Committee invite Tenders for the Supply of 12,000 (Twelve Thousand) Tons of Screened GAS COAL, to be delivered at their Gas-Works Siding, Malvern Link (Great Western Railway), between the 1st of July, 1907, and June 30, 1908, in such quantities monthly as may be required.
Further Particulars, Tender Form, and Specification may be had on application to the Engineer and Manager, W. J. Rendell Baker, Council Offices, Malvern.
Sealed Tenders, endorsed "Gas Coal," to be delivered to the undersigned on or before Ten a.m., on Wednesday, the 12th of June, 1907.
The Committee do not bind themselves to accept the lowest or any Tender.
H. L. WHATLEY,
Solicitor, Town Clerk.
Council Offices, Malvern,
May 25, 1907.

WOLSTANTON UNITED URBAN DISTRICT COUNCIL.

NEW GAS-WORKS, CHESTERTON, STAFFS.

CONTRACTORS are invited to submit TENDERS for a RETORT-BENCH of Seven Arches, together with Chimneys and Accessories, at the Gas-Works, Chesterton.
Copies of the Drawings and Specifications may be obtained from the Engineers, Messrs. Corbet Woodall and Son, Palace Chambers, Bridge Street, Westminster, S.W., upon payment of a deposit of £3 3s. (by cheque). The deposit will be returned upon receipt of a *bonâ-fide* Tender.
Tenders will be received by the undersigned not later than Ten a.m. on Monday, the 10th of June, 1907.
The lowest or any Tender will not necessarily be accepted.
EDWARD HOLLINSHEAD.
Clerk to the Council.
Town Hall Chambers,
Tunstall, Staffs.

PAIGNTON GAS COMPANY.

TENDERS FOR GAS COAL.

THE Directors of the Paignton Gas Company are prepared to receive TENDERS for the Supply of 4500 to 5000 Tons of best approved GAS COALS, to be delivered in such quantities and at such times as may be required, and to weigh 20 cwt. to the Ton over the Gas Company's Weighbridge.
Tenders to be accompanied by Practical Working Analysis, stating the Price of the Coal delivered at Paignton Station, Great-Western Railway, free of all charges.
Forms of Tender are not supplied.
The Directors do not bind themselves to accept the lowest or any Tender.
Further Particulars may be obtained from Mr. C. G. Dawson, Manager.
Sealed Tenders, endorsed "Tender for Coal," specifying the description and quality of Coal, to be sent on or before the 22nd day of June, addressed to the undersigned, at the Gas Offices, 1A. Victoria Street, Paignton.
F. W. PUDDICOMBE,
Secretary.
Paignton, May 14, 1907.